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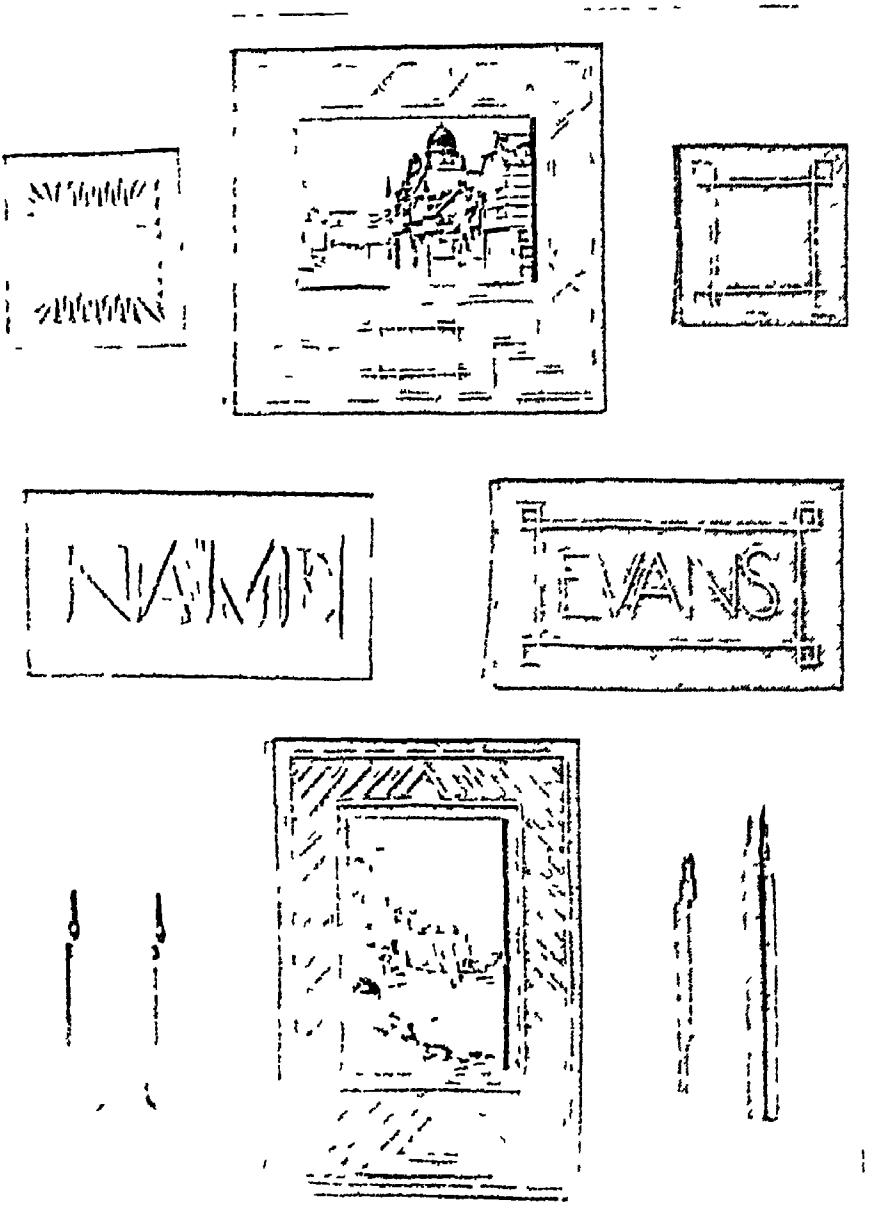
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I SIMPLE CARVING IN LINOLEUM

THIS PHOTOGRAPH SHOWS THE TOOLS USED IN CUTTING LINOLEUM AND SOME EXAMPLES OF PRACTICAL VALUE LINOLEUM MADE IN PLAIN COLOURS WITHOUT A PATTERN SHOULD BE USED THE CUTS CAN BE PAINTED IF DESIRED

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BY

A. C. HORTH, F.R.S.A.

AUTHOR OF

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FOURTH EDITION, REVISED AND ENLARGED

ILLUSTRATED BY NUMEROUS DIAGRAMS AND A SERIES OF TOOL PHOTOGRAPHS

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PREFACE TO THE THIRD EDITION

THE continued success of " 101 Things for a Boy to Make " has rendered a third edition necessary The author has taken the advantage of the new edition to re-write and re-arrange the whole of the contents

As many of the illustrations in the previous editions were small, nearly all the diagrams have been re-drawn to the full size of the page, thus making the book correspond in make-up to the author's later volumes in the series of 101 Things To Do

Some of the articles included in the previous editions have been omitted as they are fully treated in other volumes, their place has been taken by many new articles which will, the author hopes, make the book still more useful to the boy who likes to make things

GUILDFORD,

September, 1938

PREFACE TO THE FIRST EDITION

IN arranging this collection of 101 Things for a Boy to Make, the Editor has made a wide selection in order to give scope for the beginner who possesses just a few tools with only limited opportunities for using them, as well as for the young craftsman who has had some experience and is skilful with his hands

There are few boys who do not wish to make useful things, or who would not like to be able to do some of the odd jobs to be found in every household It is for the boys who are handy with tools and are on the look out for suitable occupation, that this book has been compiled

In the following pages there is something suitable for every boy who likes to use his spare time in taking up a hobby There are suggestions for the young woodworker and the metal-worker, for the budding engineer and the model maker There are opportunities for the outdoor worker, in garden appliances and simple concrete work There is work for the handyman in dealing with everyday repairs or in adjusting the electric bell, or battery There are useful things that can be made in the home workshop, on the kitchen table, or by the fireside, and others that can be made in preparation for the holidays and the seaside

Many of the articles have appeared in the " Junior Craftsman," published by the Institute of Handicraft Teachers, and are reproduced by permission.

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FITTING UP A WORKSHOP

Many boys are able to make use of a spare room, an attic or a shed in the garden for use as a workshop. In this case it is as well to fit it with a bench, cupboards, and sawing stool so that work can be carried out under the best conditions.

The illustration on page 3 shows a corner of a spare room conveniently adapted as a workshop without unnecessary alterations. The bench should be placed under the window, if possible, and, if any work is likely to be done after dark, a good light should be arranged over the top of the bench.

One of the recesses adjoining the fireplace could be filled in with shelves and used for books as well as tools; if the lower part is fitted with doors, all tools can be kept quite tidy. At least a cupboard of some sort should be provided; a simple form, quite easily made from wood from packing cases, is shown on the wall.

The sawing stool, shown in the foreground, can be made from wood about 2 in. by 2 in. to 3 in. by 3 in., the length may be from 2 ft. to 2 ft. 6 in. long, but the height should equal the height of the knee. It is an advantage to make the top piece 4 in. wide.

It is possible to purchase benches ready made at a price little more than the cost of the wood, but with suitable material at a reasonable price a serviceable bench can be made without difficulty.

The bench shown in Fig. 1 can be made with four legs, cut to a convenient height, using wood 2 in. thick, and from 4 in. to 6 in. wide. The cross pieces at the bottom are housed in; those at the top should be dovetailed and cut to about 2 ft. 6 in from the same material. Join the sides in front

and at the back with similar material from 5 ft. to 6 ft. long, and form the top with either 2 in. or 1½ in. boarding. The vice can be made with a wood screw attached to a length of 2 in. wood.

A bench suitable for fixing to the wall is shown at Fig. 2. It is made by cutting a 6 ft. length of 2 in. by 2 in. wood A, with two arms B, each 21 in. long. Secure the long length to the wall with rawlplugs and screw to a suitable height, and then prepare a front piece C, to the same length, as A from wood, 9 in. by 1 in. Cut out two legs, D and E, and place them in position at a slight slope, so that the top edge of the front piece is level with A. Notch the inside top corners to take the ends of the B pieces, and leave space for the top board F, which should be 6 ft. by 11 in. by ½ in. The other pieces for the top need not be more than ¾ in. thick. A vice can be made with a piece of 9 in. by 2 in. or 1½ in. wood as at G; instead of a wooden bench screw, it is a simple matter to use a large bolt and wing nut as shown as H.

Vice screws as shown at J can be bought ready to fix in position, but it is better to fit metal vices as they are much more satisfactory in use; two kinds of vice are shown at K and L.

If it is impossible to fit up a special workroom, the kitchen table can be utilised by fitting a bench-top to it with G cramps as shown at M. The piece resting on the table should be about 11 in. by 1½ in., this is screwed to an edge piece about 6 in. by 1½ in. Instead of a vice, screw on a block with a V shaped opening, and bore some holes along the edge piece for pegs on which the wood to be planed can be rested.

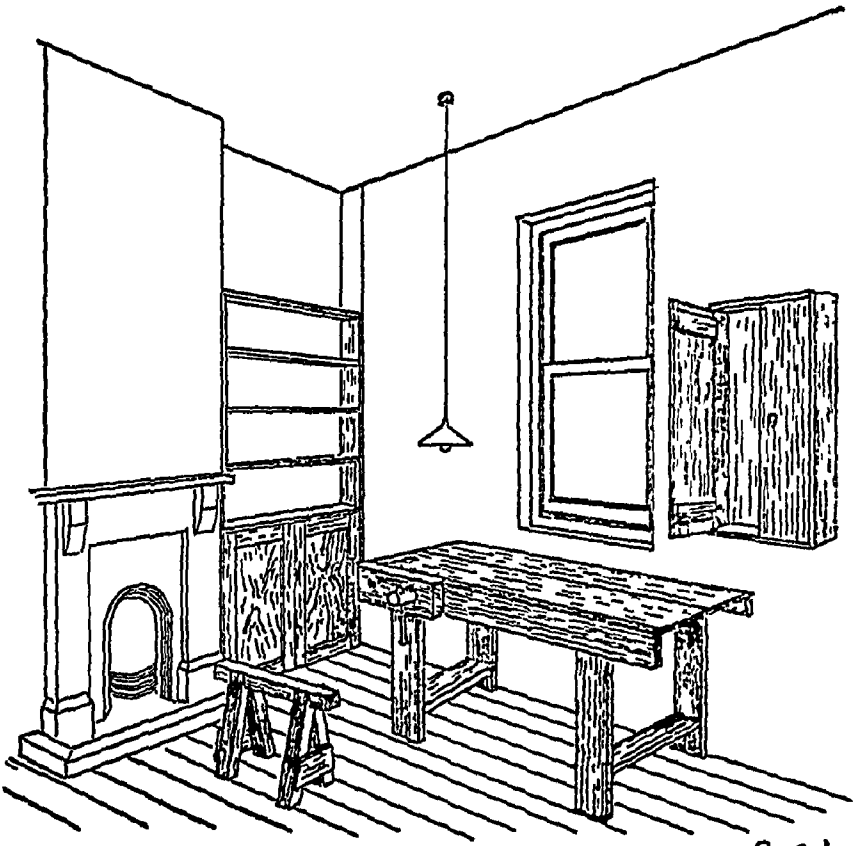


Fig 1

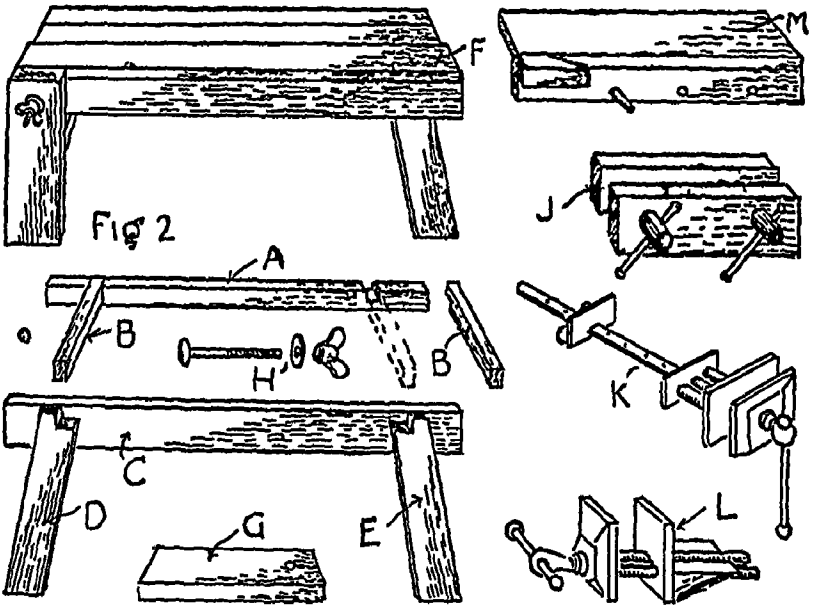


Fig 2

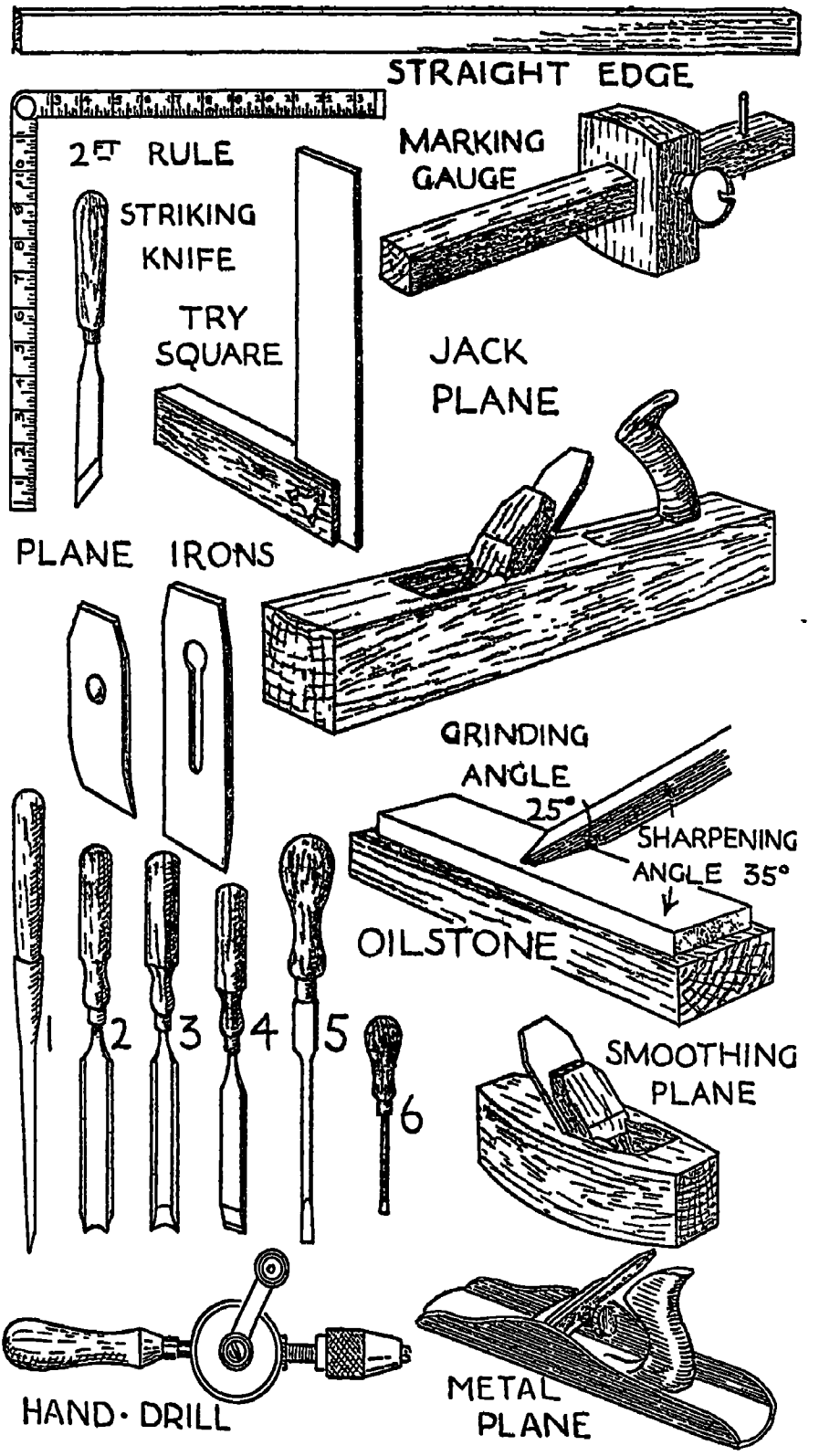
THE CARE AND USE OF WOODWORKING TOOLS

Woodworking tools do not always get the care they should have; but if they are treated properly and kept in good condition, it will not be their fault if the work they are called upon to execute is not of the best. There is a good old adage which says, "Bad workmen always blame their tools," and it is as true to-day as it was when some ancient wiseacre first used it.

No self-respecting woodworker allows his tools to be jumbled up together, with the chisels cutting into the sole of the planes and the hammer and pincers destroying the sharp edges of the chisels.

As a general rule, each tool should be used only for the purpose it is intended; there is no reason why the chisel should not be used for sharpening a pencil, but the plane should certainly not be used for cleaning off the top of nails. Timber is a beautiful material to use and its shaping can be made a pleasure and should be a delight; but this can only be when the tools are in good condition. It is often a matter of laziness when woodwork is carelessly done; a cutting tool must be sharp and must be kept sharp, and therefore the oilstone should be continually in evidence.

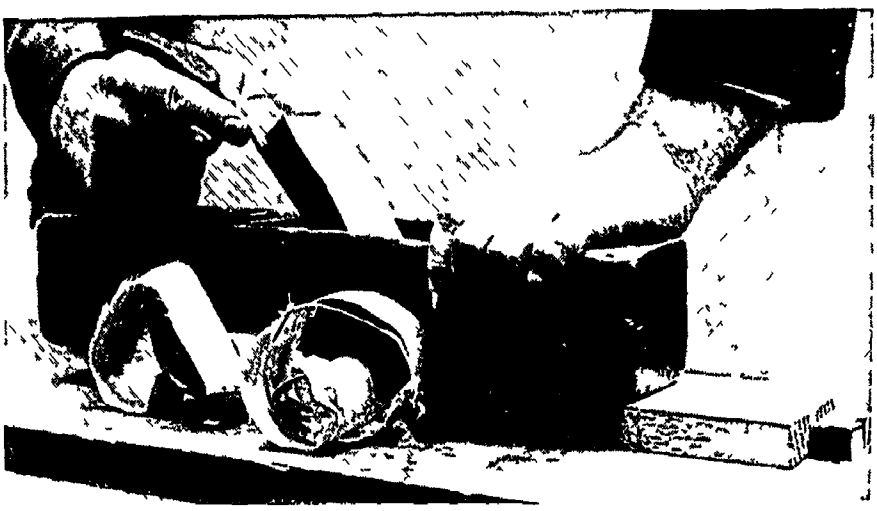
It is essential that the tools should be of the best quality; a chisel that is not made of best cast steel, correctly hardened and tempered, is only a source of trouble. There are a large number of tools now on the market which to the inexperienced appear good value, but unfortunately they will not, in a large number of cases, stand the test of wear. Without a consid-


STRAIGHT EDGE
2FT RULE
MARKING GAUGE
STRIKING KNIFE
TRY SQUARE
JACK PLANE
PLANE IRONS
GRINDING ANGLE 25°
SHARPENING ANGLE 35°
OILSTONE
1
2
3
4
5
6
SMOOTHING PLANE
HAND-DRILL
METAL PLANE

erable amount of knowledge it is almost impossible to judge a tool by its appearance; it is therefore most important that all tools should be purchased from a reputable firm, and above all, they should bear some guarantee.

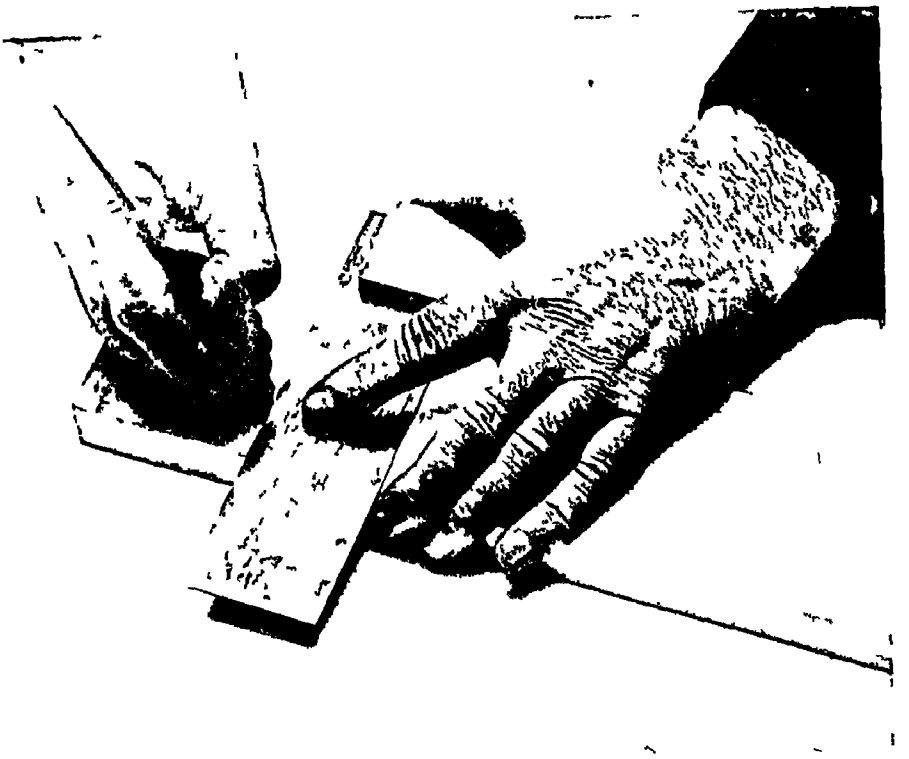
The most useful form of plane for the amateur woodworker is undoubtedly the Jack Plane. It may be used not only for rough planing but if the iron is sharp, it is capable of executing a good finish. Although the wooden plane, shown on page 5, is by far the commoner one, a metal plane has several advantages. No matter how well-chosen and well-seasoned a beech plane is, it is liable to warp and wear, these objections do not apply to the metal plane. The adjustment of the wood plane cannot be so accurately made as in the latter, the main advantage and practically the only one is in the price: a best quality beech plane costs 12*s*. 6*d*., while a Record jack plane costs 18*s*. 6*d*. This extra cost is worth while as a metal plane will last a lifetime.

The wooden plane should be carefully chosen if a new one is being purchased, the best planes are cut so that the medullary rays of the wood are vertical or at right angles to the sole. This method of cutting out the block minimises the risk of warping. The cutting iron is mainly composed of iron, but a facing of finest steel is welded on as indicated by the lighter portion. This portion of steel occupies less than half the thickness of the blade but is sufficient to provide a keen cutting edge. The cap iron is of steel and slightly curved and is kept close to the cutting iron by means of a screw which fits in the slot of the back iron.



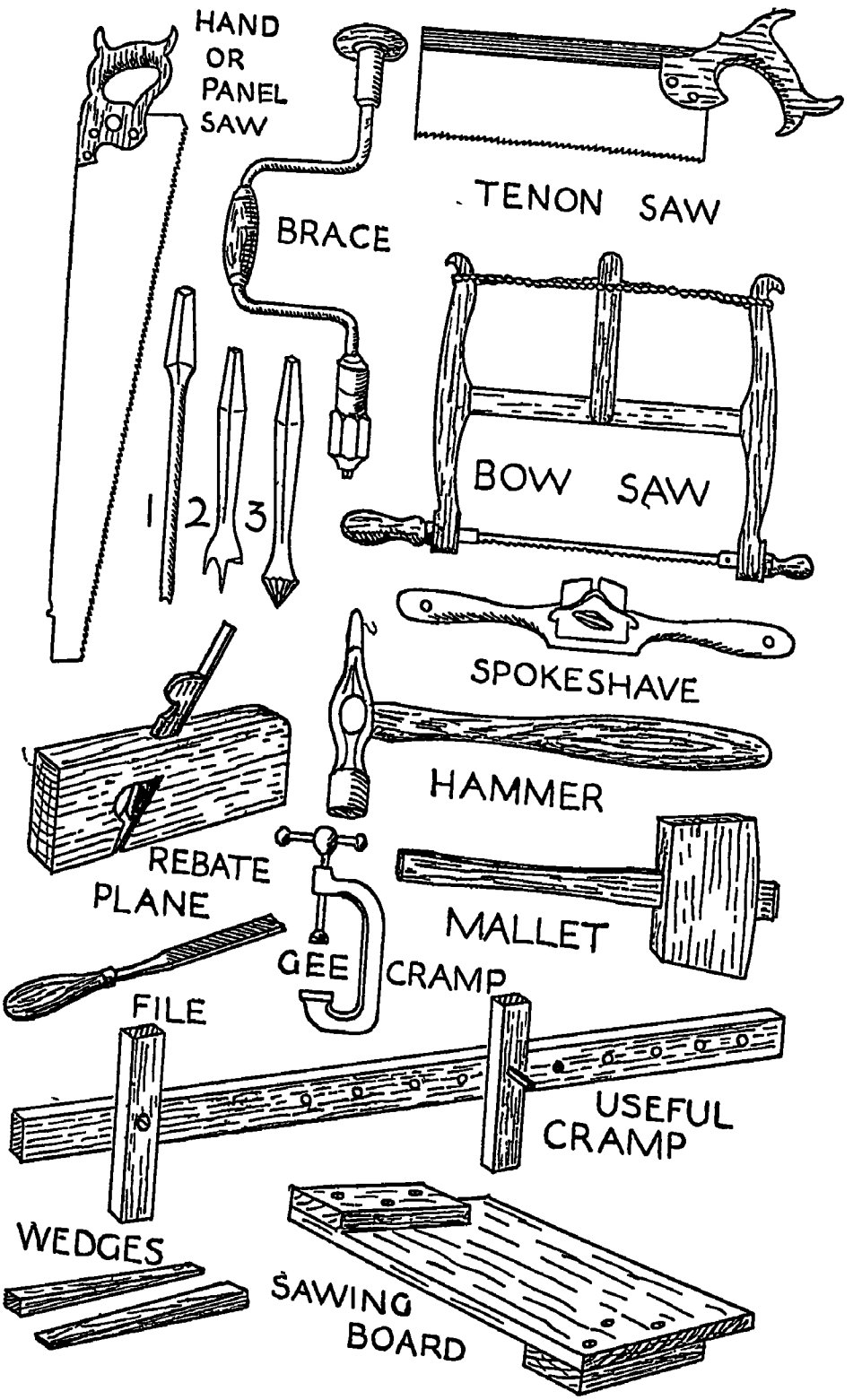
2 HOLDING THE JACKPLANE

THE FRONT OF THE PLANE SHOULD BE PRESSED CLOSE TO THE WOOD AT THE BEGINNING OF THE CUT TRANSFER THE PRESSURE TO THE BACK OF THE PLANE DURING THE STROKE AIM AT CUTTING A COMPLETE SHAVING AS SHOWN



3. USING THE MARKING KNIFE

ALWAYS HOLD THE TRYSQUARE FIRMLY TO PREVENT THE KNIFE SLIPPING KEEP THE EDGE OF THE KNIFE QUITE SHARP


HAND OR PANEL SAW
BRACE
TENON SAW
1
2
3
BOW SAW
SPOKESHAVE
HAMMER
REBATE PLANE
MALLET
GEE CRAMP
FILE
USEFUL CRAMP
WEDGES
SAWING BOARD

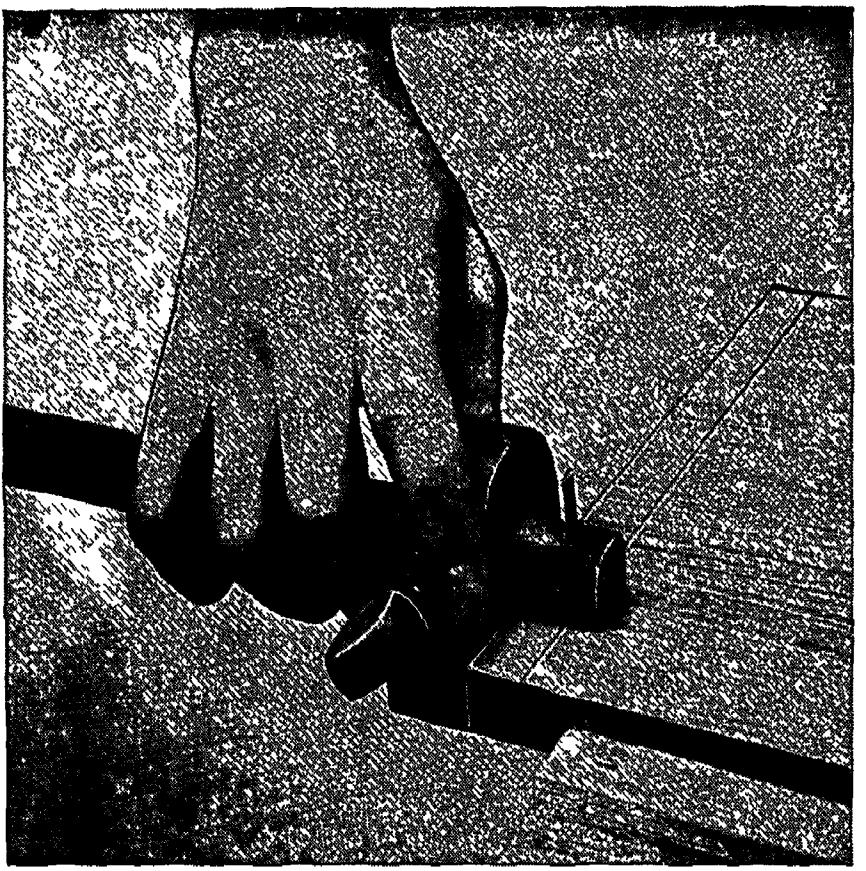
The space between the cutting edge and the edge of the cap iron depends on the wood to be planed. For soft woods such as deal or pine a space of $\frac{1}{16}$ in. is suitable, but in the case of hard woods this amount should be reduced to half.

The angle at which the plane iron is fitted in the plane is 45 degrees (the angle of the mitre). The cutting edge should be sharpened on one side only, the correct angle being 35 degrees; the blade should be ground to 25 degrees.

All the tools needed for ordinary work are shown on pages 5 and 7. There is no need to buy them all at once, but when they are purchased, they should be of the best quality. The rule should be of steel, the 2 ft. size is most useful. A straight edge can be made from beech placed to $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. and about 2 ft. long. It is convenient to have a striking or marking knife to use with the try square; this can be obtained all metal or with a wooden stock as shown.

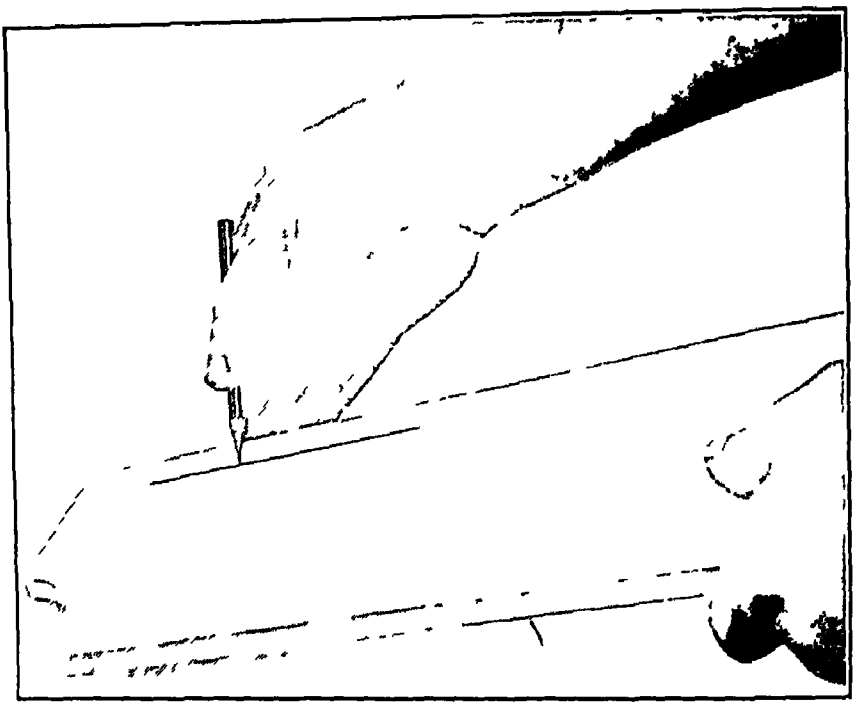
Marking gauges are made of beech and, if possible, have in addition a mortise gauge. Although not essential a set of mortise chisels of the shape shown at 1 will be very useful. Some firmer gouges as at 2, and one or two scribing gouges as at 3, are always handy. A set of chisels as at 4 are essential; $\frac{1}{4}$ in., $\frac{1}{2}$ in., $\frac{3}{4}$ in. and 1 in. sizes will do for a start. The type of screwdriver at 5 and the bradawl at 6 are suitable.

A small hand-drill with a set of bits should be provided in addition to the brace and bits as on page 7. Some pin and centre bits will be required, and a rose countersink bit is very useful for countersinking screw holes.



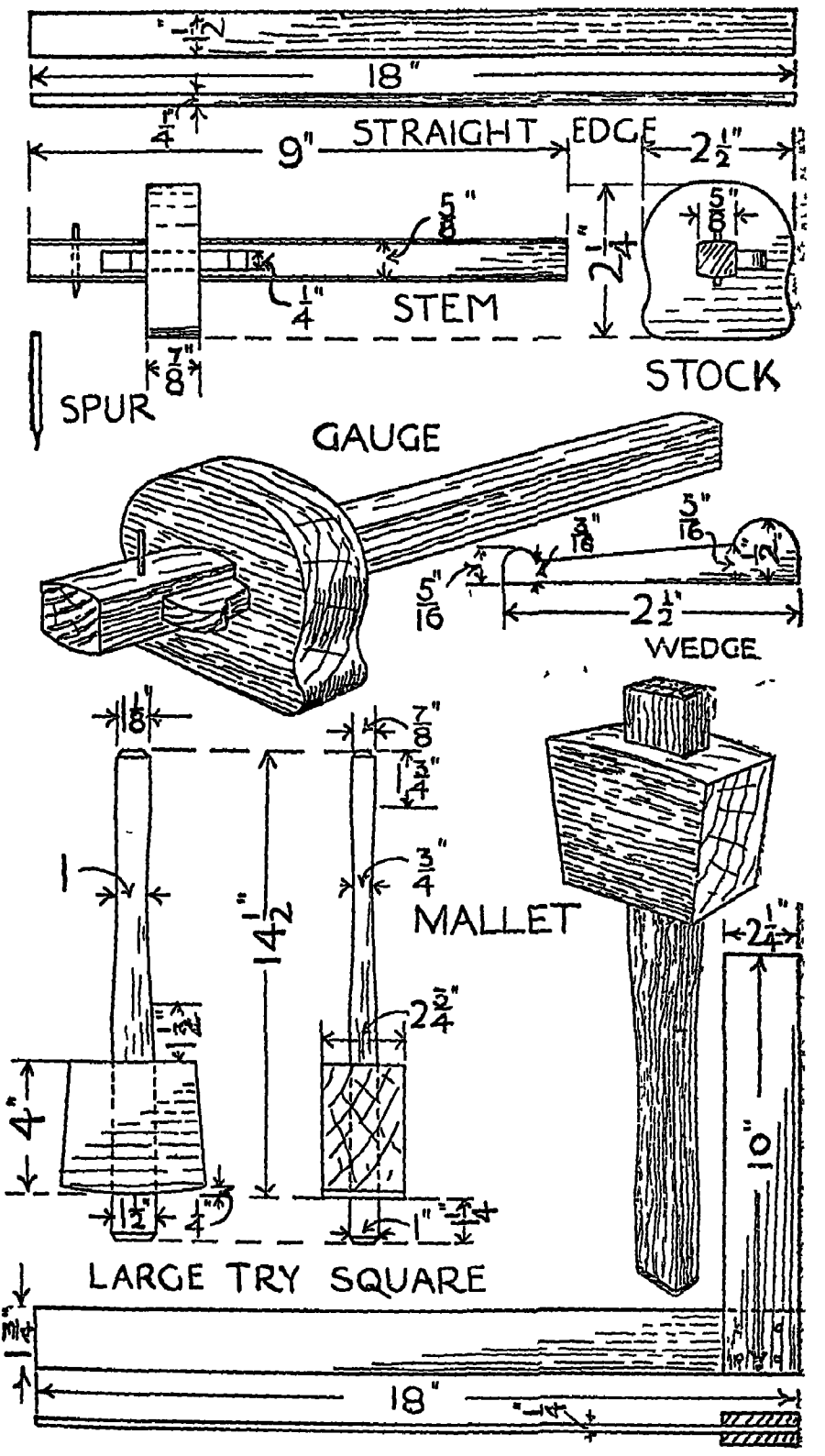
4 USING THE MARKING GAUGE

HOLD THE GAUGE AS SHOWN ABOVE AND PRESS IT AGAINST THE WOOD THE GAUGE SHOULD BE PUSHED ALONG THE EDGE OF THE BOARD WITH THE SPUR JUST TOUCHING THE SURFACE



5 MARKING WITH A PENCIL

IT IS NOT ALWAYS NECESSARY TO USE A MARKING GAUGE FOR MARKING LINES PARALLEL WITH AN EDGE THIS PHOTOGRAPH SHOWS HOW THE PENCIL CAN BE HELD WITH THE FINGERS AND THUMB


18"
9" STRAIGHT EDGE
2½"
5/8"
2¼"
1/4"
STEM
7/8"
SPUR
STOCK
GAUGE
3/16"
5/16"
2½"
WEDGE
7/8"
1¾"
3/4"
1
14½"
MALLET
2¾"
4"
2¼"
10"
LARGE TRY SQUARE
18"

A good hand or panel saw as well as a tenon saw must be provided, and for curves, the bow saw is better than a pad saw, although the latter is very handy. One or two hammers, a mallet and metal spokeshaves for inside as well as outside curves should be included. Tools as G cramps, rebate planes, files and rasps can be added as needed.

Many tools can be made; for example, the cramp shown on page 7 is made with a length of 2 in. by 1 in. wood with cross pieces of similar width and thickness. One piece is screwed on, the other is loose and kept in position by a birch dowel fitted in holes driven at every 2 in. or so, thin wedges are provided to tighten up the work in the cramp. The sawing board on the same page is also easily made with a 12 in. by 8 in. by $\frac{3}{4}$ in. board with pieces of 2 in. by 1 in. wood screwed on.

The various tools shown on page 9 give suggestions to work on. The straight edge made from $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. hardwood is useful alone; if two are made they form excellent testing strips for use in planing, but they must be quite true and exact in every particular. The marking gauge shown has a wedge instead of a screw and made to the dimensions given will be quite satisfactory. Suitable sizes are also given for a mallet and a large try-square, which will be found most useful.

A suggestion is given on page 11 for a glass-papering block. In all glass-papering, the paper should be kept flat, and in the block suggested, allowance has been provided for working on rounds, in hollows and corners The inner block should fit tightly in the space provided when the paper is in position.

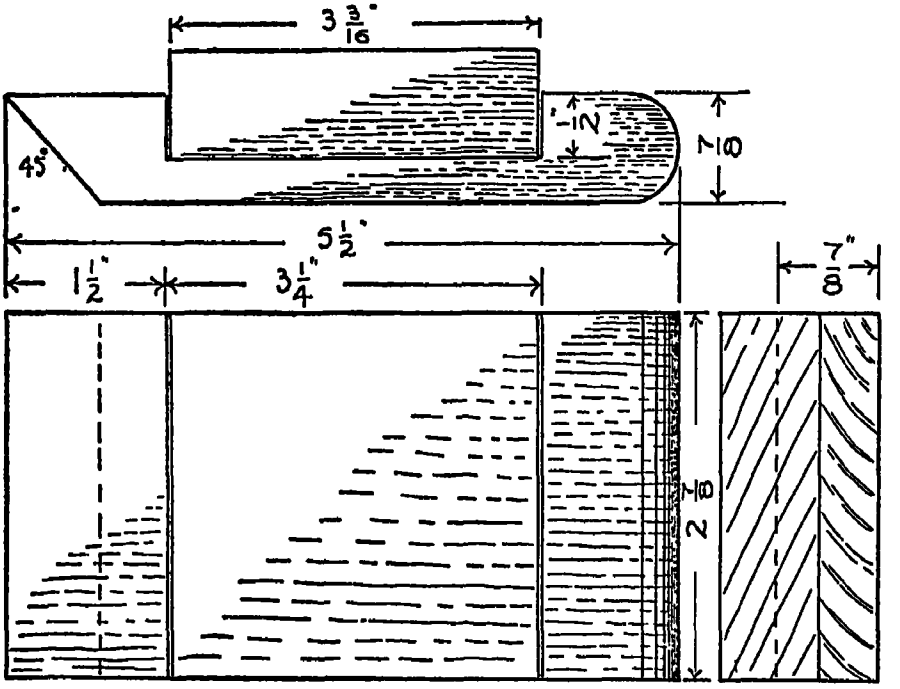


Fig 1

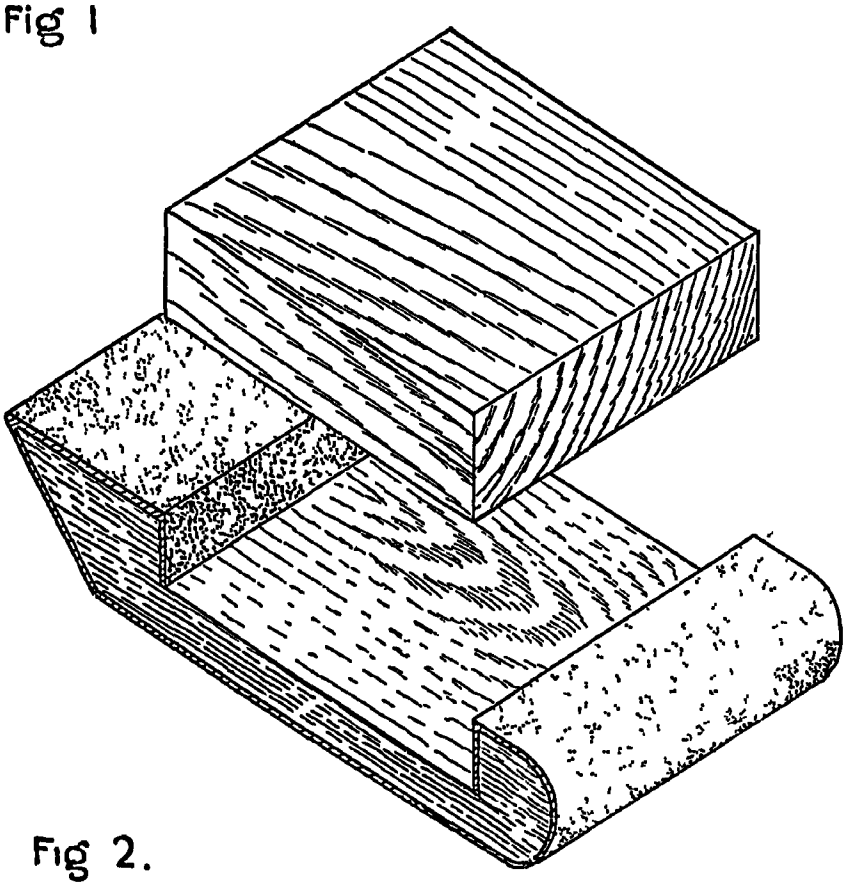


Fig 2.

HOW TO CUT GROOVES

Next to the lapped halving joint, the tongue and groove is the simplest form of joint used in woodwork, the marking should be exact and both the marking edge and the surface must be true.

In planing the wood in the first place, see that the surface is true in length as well as in width, and make quite sure that the edge is also true in length as well as square. Place a mark on the wood, as shown at Fig. 1, so that all marking can be done from the same edge.

Set out the width of the grooves exactly and cut the line in, deeply with a marking knife. In gauging the depth of the grooves, always work from the face side, shown in top at Fig. 1, and incline the spur of the gauge as indicated at Fig 2.

When ready to cut the grooves use a sawing board, as at Fig. 3, and proceed as shown at Fig. 4. In all grooves the saw cut should be made on the waste side of the line in each case, taking care to saw gradually to the gauge line and finish with the saw quite level. Correct sawing is of the utmost importance and cannot be done too carefully.

When the sides of the groove have been sawn, begin cutting with a chisel, somewhat narrower than the groove, and work down to the gauge line on one side as shown with an upward sloping cut. Turn the wood to the other side and repeat, finally work with the chisel level to remove the waste.

Stopped grooves are more troublesome. Cut a slot, as at Fig. 5, to the correct depth and start the saw cut from the edge of the slot. Incline the saw to begin with and gradually bring it level. Chisel as in the straight groove and finish level.

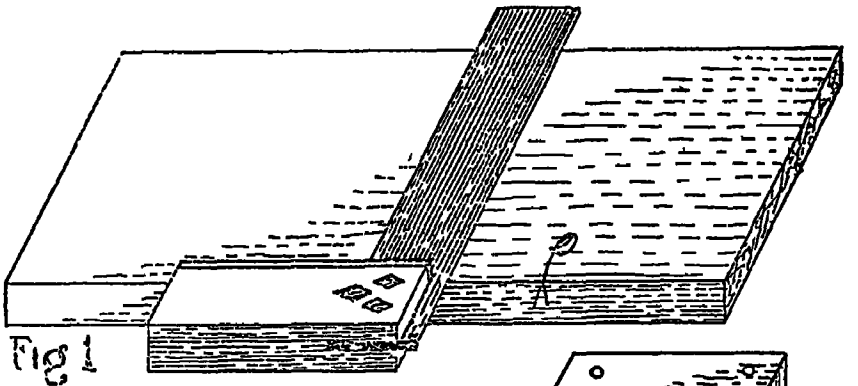


Fig 1

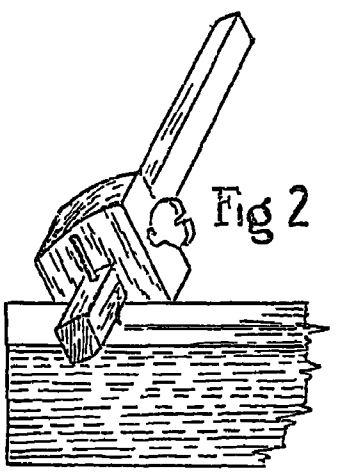


Fig 2

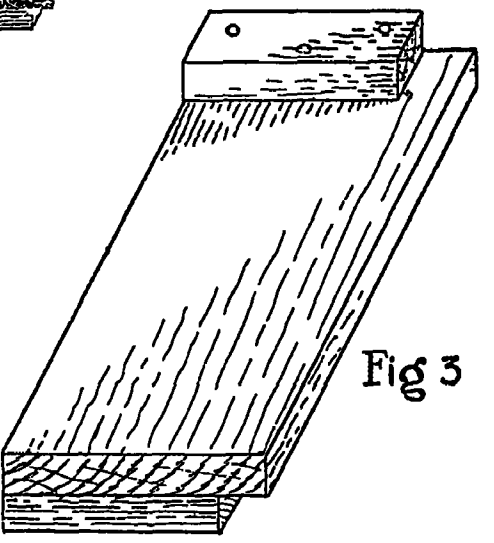


Fig 3

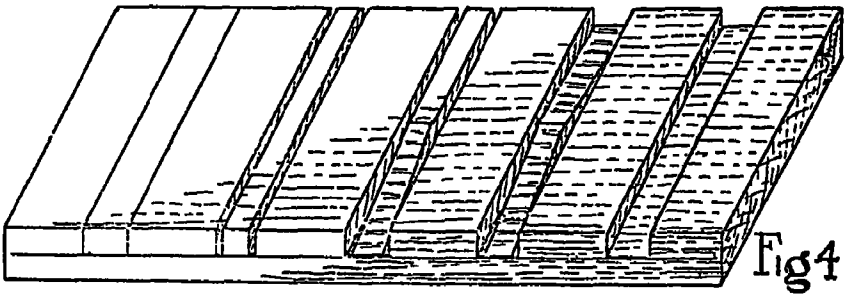


Fig 4

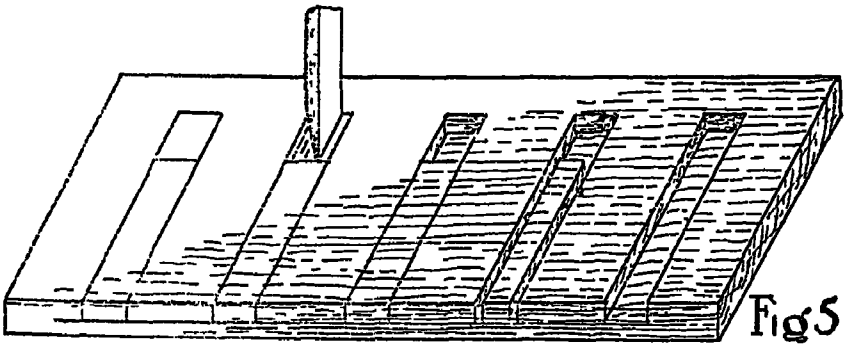


Fig 5

THE MORTISE AND TENON JOINT

There is very little constructional work in wood that does not contain the mortise and tenon joint; the craftsman who aspires to good workmanship should be able to make the joint perfectly. It will be seen at Fig. 1 that one piece is cut to form a tenon and is fitted in a hole or mortise cut in another, the two pieces forming a right angle.

As a general rule the tenon should be about ⅓ of the width, but to be accurate, the gauge lines should be set to the width of the chisel nearest in size. The gauge lines should be made, if possible, with a mortise gauge, but the ordinary gauge as shown at Fig. 2 can be used. The tenon should be cut with the tenon saw as at Fig. 3, care being taken that the waste of the saw cut is on the waste side of the line. The first cuts are as at Fig. 4, the wood being turned the other way to complete the cuts. In cutting the mortise, hold the chisel as at Fig. 5 and make a V shaped opening as at Fig. 6. Turn the wood over and repeat as at Fig. 7, it will then be a simple matter to finish the sides.

Where the mortise comes at the end of the wood as in the bridle joint, the sides can be cut with a saw as at Fig. 8. Another form of the joint at Fig. 9 is called the haunched mortise and tenon; it requires very careful marking out. The pinned joint at Fig. 10 is useful for large joints such as are used in making garden gates, the hole in the tenon is a trifle nearer the shoulder than those in the sides of the mortise, this allows of the tenon being pulled up tight. The wedged joint, Fig. 11, is often used in heavy work and in cases where the tenon does not go through the wood.

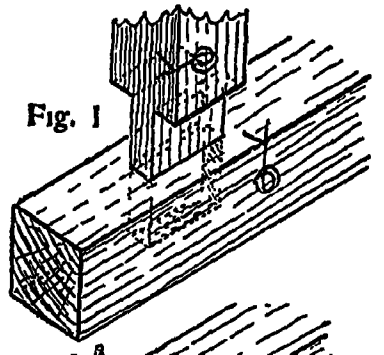


Fig. 1

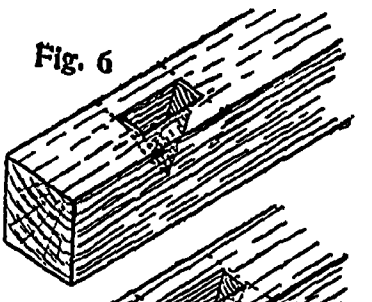


Fig. 6

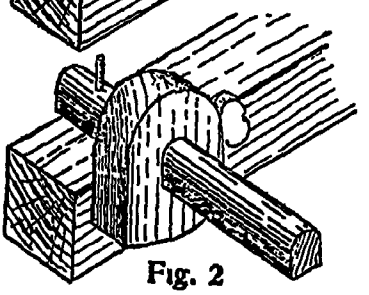


Fig. 2

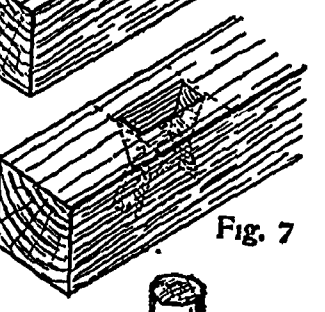


Fig. 7

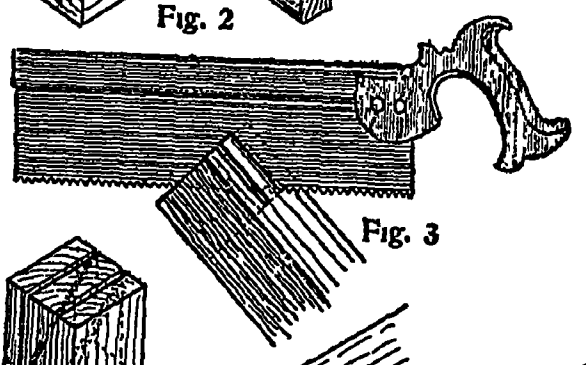


Fig. 3



Fig. 5



Fig. 4

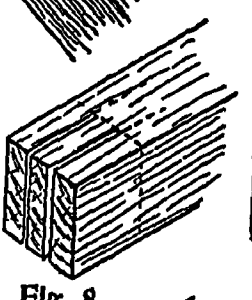
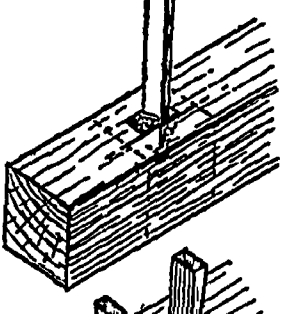


Fig. 8



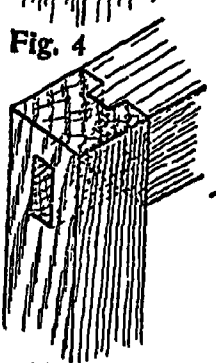


Fig. 9

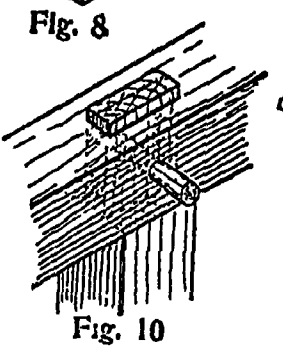


Fig. 10

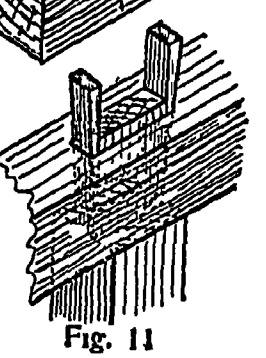


Fig. 11

SIMPLE CORNER JOINTS

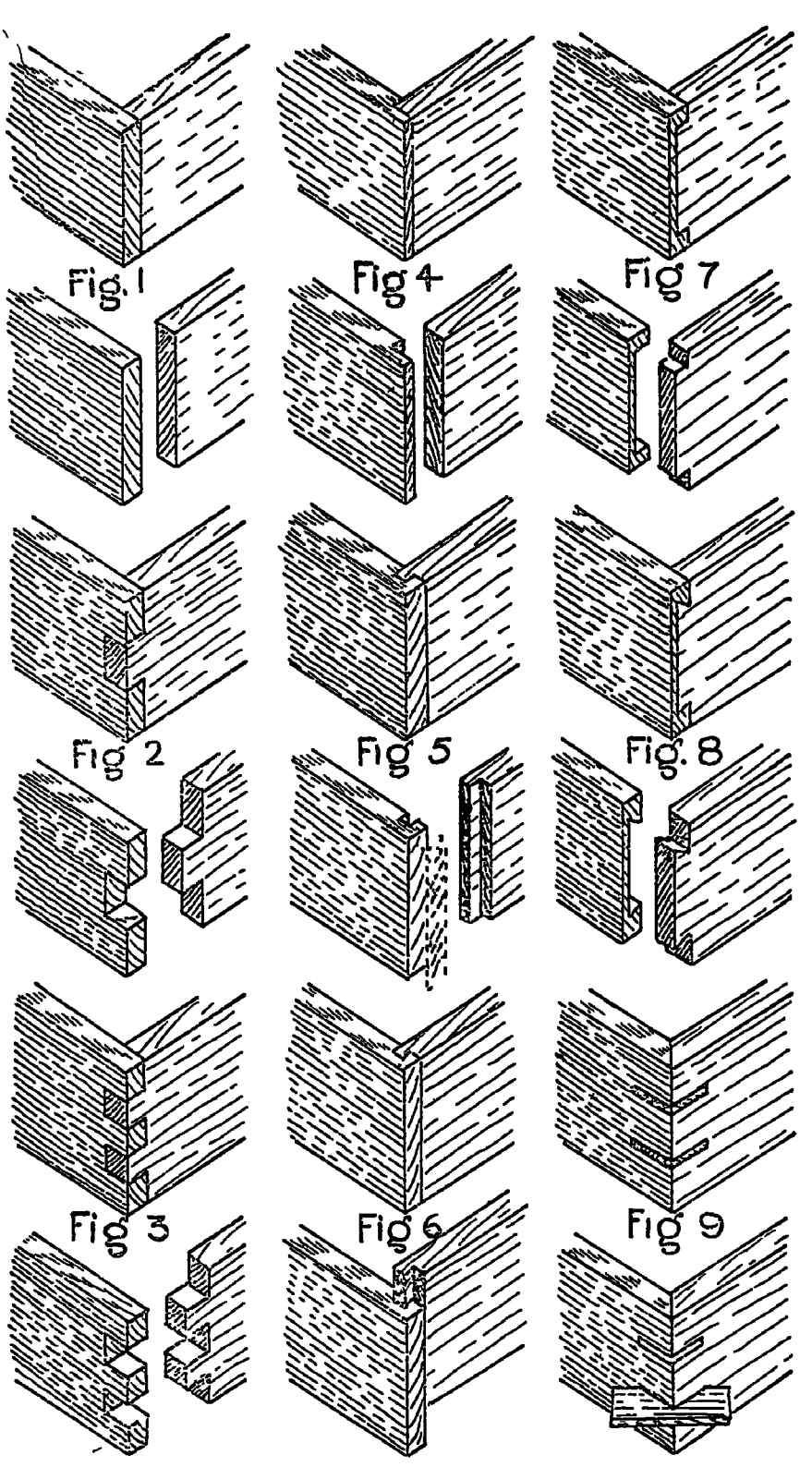
The simplest method of joining the ends of two pieces of wood is shown at Fig. 1 and is known as the "butt" joint. The ends must be quite square, and the constant use of the trysquare is essential in making a true joint. The joint should be glued and strengthened with nails or screws.

When additional strength is needed an adaption of the bridle joint is used as indicated at Fig. 2. In this case we have portions of both ends interlocking. In marking out the two ends as shown care must be taken that the marks on each piece correspond. The marks across the grain should indicate exactly the thickness of the wood and the lines along the grain drawn at the same time with a marking gauge, to give accuracy. In sawing out the parts, care must be taken to mark the waste, and saw on the waste side of the line.

A development of the above joint is shown at Fig. 3 in the form of the lock-corner joint, a method now commonly utilised by machine box-makers. The ends are usually divided into divisions equalling the thickness of the wood.

Quite another type of joint is shown at Fig. 4, is very useful when a neater method of applying the butt joint is required. The full width of one piece is fitted in the notched or rebated end.

The tongue and groove is shown at Figs. 5 and 6. When cutting the groove leave some waste as shown by the dotted lines. Two useful corner joints are shown at Figs. 7 and 8, the latter is a form of the dovetail. The method of giving strength to a mitre corner joint, shown at Fig. 9, will be found very useful; use a hardwood for insets.


Fig. 1
Fig 4
Fig 7
Fig 2
Fig 5
Fig. 8
Fig 3
Fig 6
Fig 9

DOVETAIL JOINTS

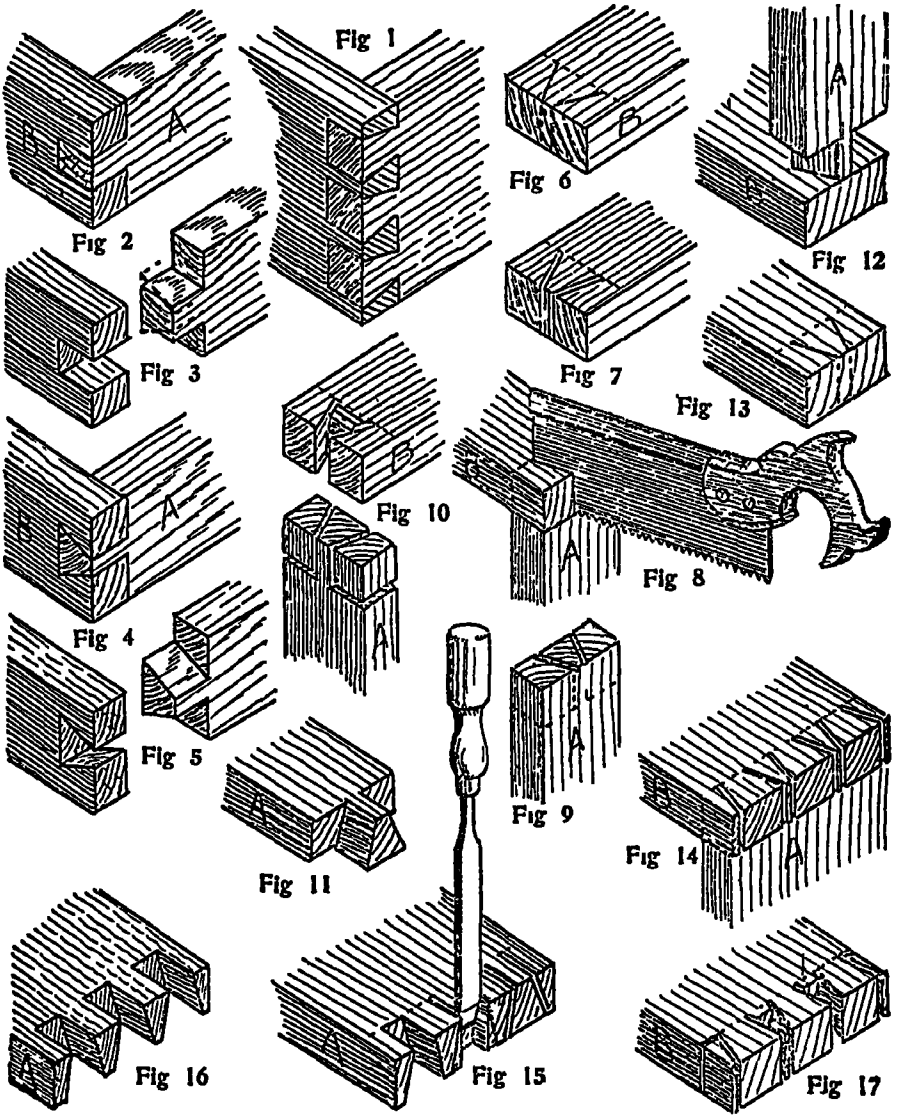
The common dovetail joint as at Fig. 1 is really not difficult at all when it is understood. Figs. 2 and 3 illustrate a single notch joint. Supposing we were to decrease the width of the top of the pin or increase the bottom as shown by the dotted lines at Fig. 3, and make the socket hole to correspond, we should have a joint similar to Figs. 4 and 5.

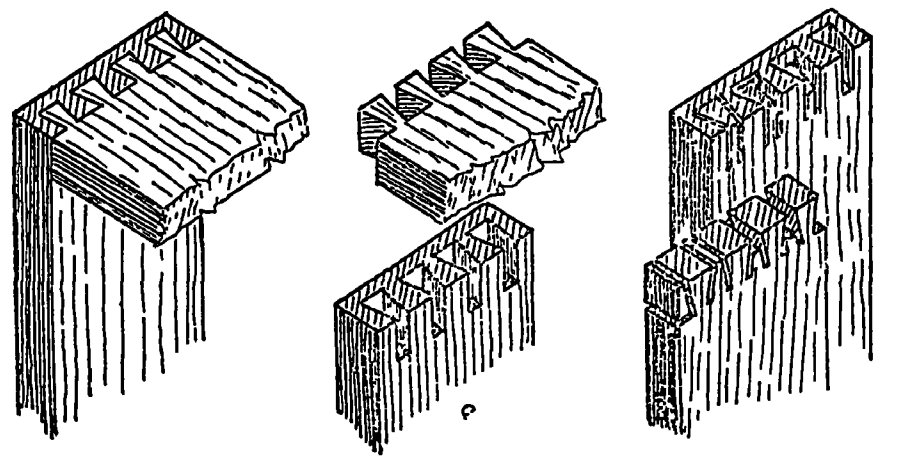
We have now a single dovetail joint. First set out the socket on the piece B as at Fig. 6. Saw down the lines as shown at Fig. 7, and place the piece on the top of the A piece and mark through with the saw as at Fig. 8. The top of A piece when B has been removed will be as at Fig. 9, finally saw on the *outside* of the saw marks. To complete remove the waste in A and B as at Fig. 10.

The other method is easier for the beginner. The pin A is made first, marking and cutting it out as at Fig. 11. The shape of the end of the pin resting on B should be marked with a pencil or knife point as at Fig. 13. The lines should be squared down the edge and then the saw cuts made on the *inside* of the line as at Fig. 7. The waste should be cut away with a chisel.

It should not be a difficult matter now to tackle a similar joint with several pins. The method of marking is shown at Fig. 14. The saw cuts should be made in the pins and they should be cut out in exactly the same way as the single method, the waste between the pins, and removed with a chisel as at Figs 15 and 16; the method of cutting the waste of the sockets is shown at Fig. 17.

The method of making a lapped dovetail is shown at the bottom of the page.


Fig 1
Fig 2
Fig 3
Fig 4
Fig 5
Fig 6
Fig 7
Fig 8
Fig 9
Fig 10
Fig 11
Fig 12
Fig 13
Fig 14
Fig 15
Fig 16
Fig 17



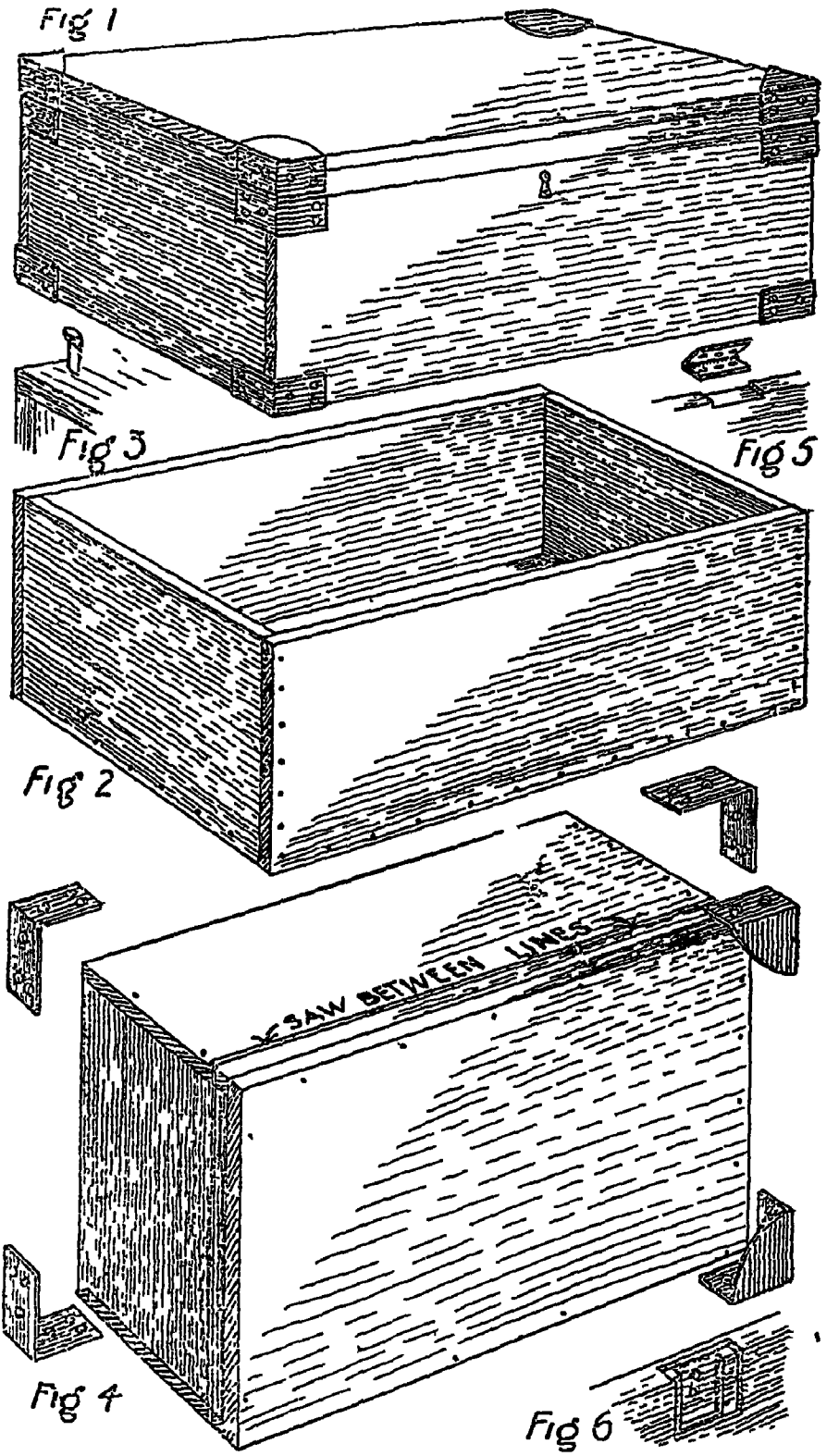
MAKING A BOX

It is not always necessary to use the dovetail joint in box making, the butt joint, if properly made, nailed together and strengthened with iron angle pieces, as at Fig. 1, will stand a lot of wear.

In making a deal box, of the dimensions say of a length of 2 ft., width 15 in., and height 14 in., the wood for the sides should be $\frac{3}{4}$ in. thick. Thinner wood is not advisable, but a thickness of $\frac{5}{8}$ in. would answer. The ends should be accurately sawn and cleaned up quite square with a finely set plane. The ends of the sides should be allowed to project at least $\frac{1}{8}$ in. and cleaned off after the sides have been nailed to the ends, as at Fig. 2. Oval brads should be used as at Fig. 3.

The top and bottom may be covered with ply-wood at least $\frac{3}{16}$ in. thick, preferably $\frac{1}{4}$ in., and the angle plates screwed on. The lid portion can then be sawn off as at Fig. 4. Two gauge lines, sufficiently apart to allow for the width of the saw cut, should be made from the top of the box, and the saw carefully guided between the lines. To complete, the sawn edges are planed down to the gauge lines.

Fillets should be fitted, either inside the lid or on the sides of the bottom portion. The lid should be attached with butt hinges let in the wood as shown at Fig. 5. Corner plates and angle plates can be bought ready to screw in position. It is as well to fit these plates, if used, and remove them when painting, varnishing or polishing the box. If a lock is fitted, the recess inside should be cut out with a sharp chisel as indicated at Fig. 6. The lock to use is known as a "box lock."


Fig 1
Fig 3
Fig 5
Fig 2
SAW BETWEEN LINES
Fig 4
Fig 6

USEFUL CABINET

The cabinet shown at Fig. 1 is quite simple in construction and can be used for a variety of purposes, particularly in the workshop.

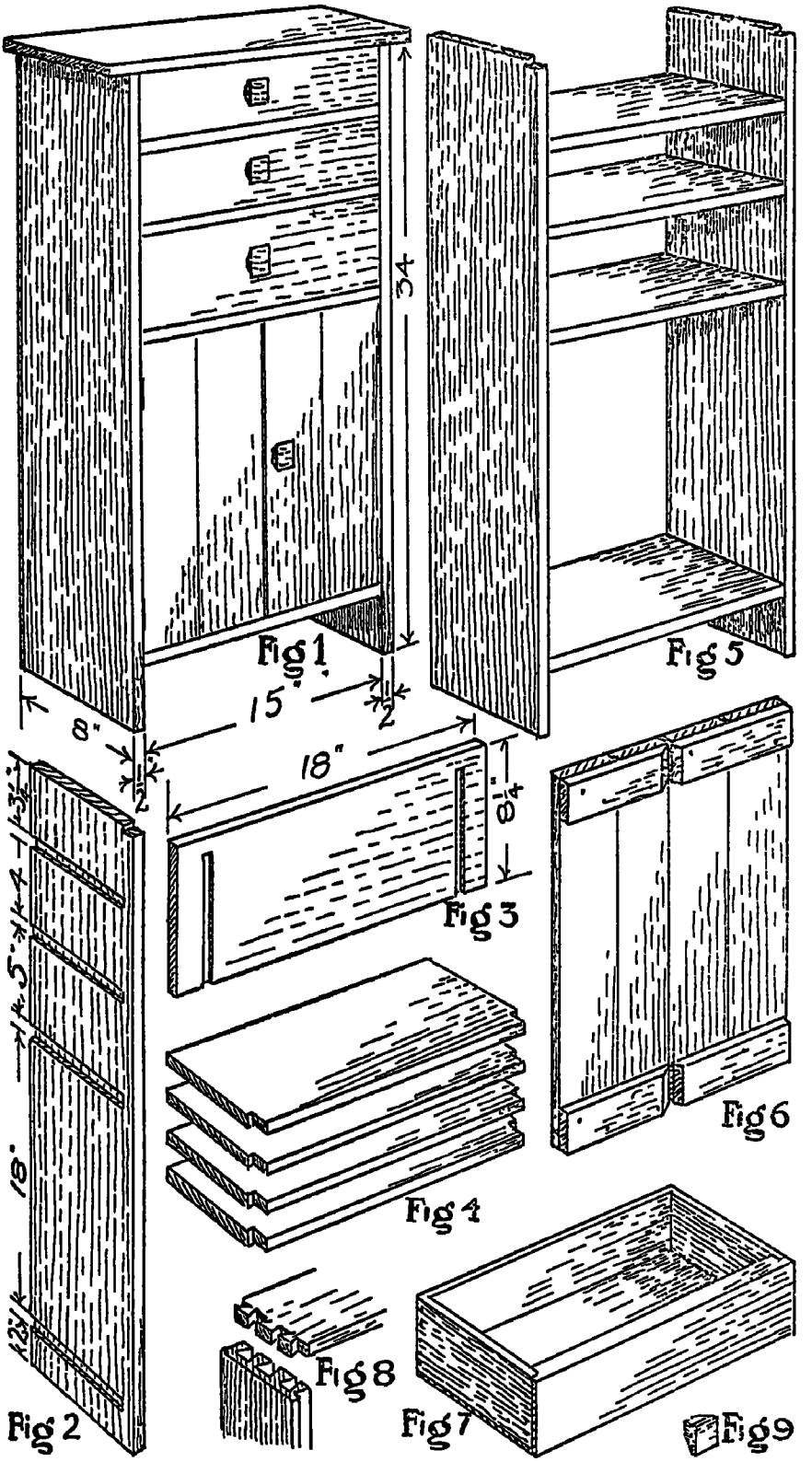
The sides should be cut to a total length of 33½ in., and marked out in pairs as at Fig. 2. The grooves should be carried down to a depth of ¼ in., and stopped within ½ in. from the front edge. The notch at the top corner is ½ in. along and ¼ in. down.

The piece for the top should be 8 in. wide and 18 in. long, this allows it to project 1 in. each side. The shelves, four in number, are all the same size, 14½ in. long and 8 in. wide. The front corners are notched ½ in. along and ¼ in. deep, as at Fig. 4.

Fit the parts together as at Fig. 5, glue up the joints and then fit the door, made as at Fig. 6. Prepare the boards to fit in the space, which should measure 18 in. by 14 in., then screw lengths of 2 in. by ½ in. wood top and bottom. These pieces serve to stiffen the thin wood, the inner corners being bevelled off to allow the door to open.

The drawers should be carefully made and the fronts are each made from wood 1 in. thick fitted in the space. The method of construction shown at Fig. 7 is quite effective. The ends of the front board are notched to take the side pieces, which should be ½ in. thick and planed down from the correct depth of the drawer to allow of a plywood bottom being nailed on. The back should be fitted inside.

The better method of making the drawers is to dovetail the sides and ends, as shown at Fig. 8. In this case the bottom of the front board should be rebated to allow for the plywood bottom. A suitable form of wooden handle is shown at Fig. 9.


34
Fig 1
15"
2
8"
2
18"
8¼
Fig 3
Fig 5
Fig 6
Fig 4
Fig 2
Fig 8
Fig 7
Fig 9

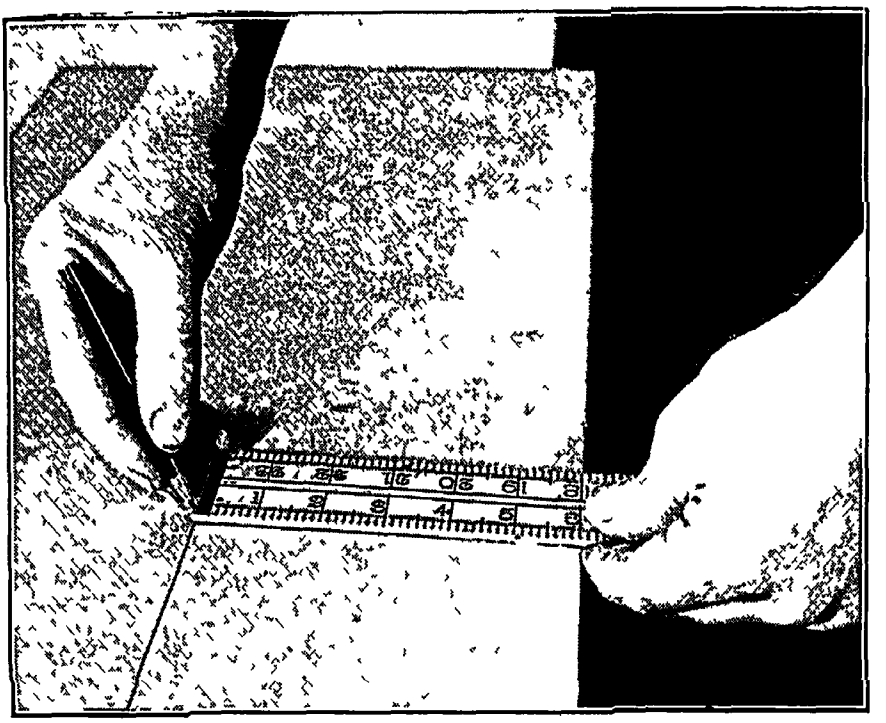
KNIFE AND PENCIL SHARPENERS

The little appliance shown at Fig. 1 will be welcomed by the owner of a knife. It is made from a 7 in. by 1 in. by $\frac{1}{4}$ in. piece of wood planed true and smooth. The curves in the centre can be made with a scribing gouge or a small spokeshave. The sides are covered with emery cloth, one piece should be No. 0, and the other cut from a piece of blue-back, which is the finest grade. Use thin glue and press the paper down firmly. If some leather can be obtained, a strip glued to the back will be found useful in obtaining a very keen edge.

The pencil sharpener shown at Figs. 3 and 4, is made of cardboard covered with book-binders cloth or any suitable fabric such as cretonne. Cut two pieces of stout cardboard or strawboard to about $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in. and paste them on the fabric to allow of $\frac{1}{8}$ in. or so between and about $\frac{3}{8}$ in. on the outsides. Use a strong paste and press the fabric down evenly, work from the centre outwards, to exclude all surplus paste. Cut the corners to form a mitre and turn them over as at Fig. 3.

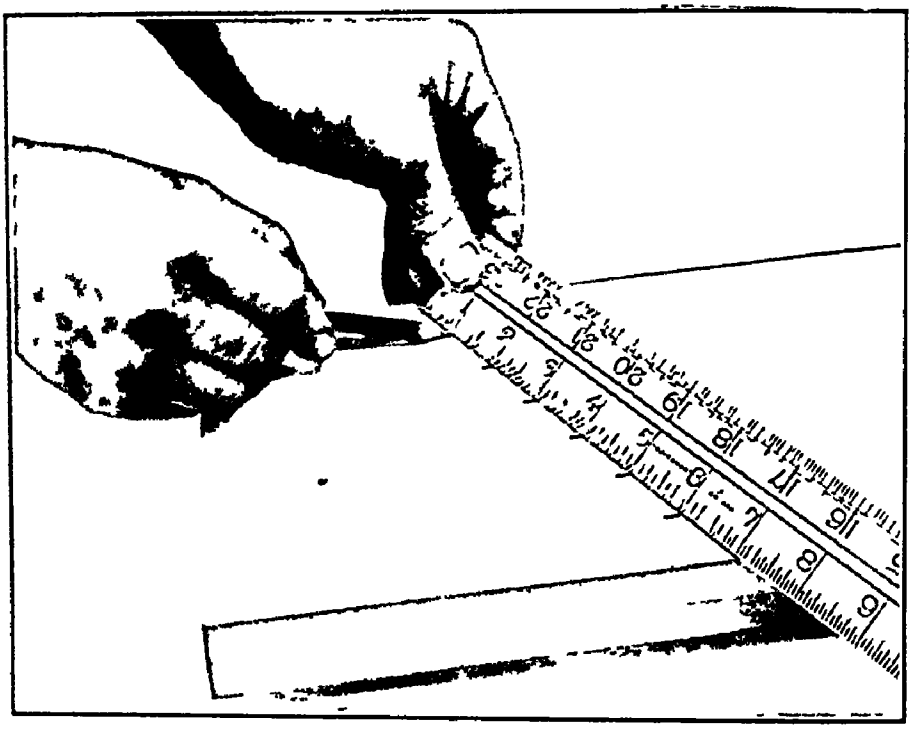
The pasted cover should be placed under pressure until the paste is dry and then the two sides can be covered with glasspaper, one of the pieces should be of a coarse grade, No. 2 is suitable; the other side should be covered with No. 0 grade. The paper should be cut about $\frac{1}{8}$ in. each way smaller than the cardboard. Glue on just as carefully and place under pressure again until dry.

Pencil sharpeners make useful presents and are always welcomed. All sorts of thin fabric can be used for covering, and failing fabric, vegetable parchment or grease proof paper can be used.



6 USING THE RULE FOR MARKING

THE ABOVE PHOTOGRAPH SHOWS A METHOD OF MARKING WITH AN ORDINARY 2-FT RULE THE FIRST FINGER ACTS AS A STOCK, BUT THE RULE MUST BE HELD FIRMLY



7 MARKING OFF EQUAL SPACES

BY USING A RULE IN THE ABOVE MANNER EQUAL SPACES ARE EASILY MARKED IN THE ABOVE EXAMPLE A BOARD 6-INS WIDE IS BEING MARKED IN SEVEN EQUAL PARTS

CLOTHES-BRUSH RACK

The rack at Fig. 1, although simple in construction, makes an effective piece of furniture.

The wood should be planed to 1 in. by $\frac{3}{4}$ in., and the sizes given, although suitable for average sized brushes, can be altered to suit any size in brushes or mirror. The two horizontal pieces should be marked together to the sizes given at Fig. 2. Considerable care should be taken in marking out, and if the wood is not exactly 1 in. wide, the width of the grooves should correspond exactly to the particular thickness.

The four vertical pieces should also be marked out together and the same care taken in marking out the grooves. In sawing the grooves, special care should be taken to saw exactly on the waste side of the line; this will not be difficult if the marked lines have been cut fairly deep with a knife.

The rebate for the mirror should be cut with a chisel. If the piece of mirrored plate is $9\frac{1}{2}$ in. by $4\frac{1}{2}$ in., the rebates should be $\frac{1}{4}$ in. wide and $\frac{1}{4}$ in. from the front of the frame. The cutting of the rebate will be eased if deep gauge lines are made, but care must be taken that gauge does not slip during the process. The easiest way to deal with the rebate is to make continuous cuts across the grain and clean out the space with a wide chisel.

When the constructional work is finished, clean up with glasspaper, paying attention to the end grain. Do not rely on the glasspaper entirely; the wood should be left smooth from the chisel. When the polishing has been done, fit in the mirror and a plywood back. Brass escutcheon pins should be used with screw-eyes on the brushes.

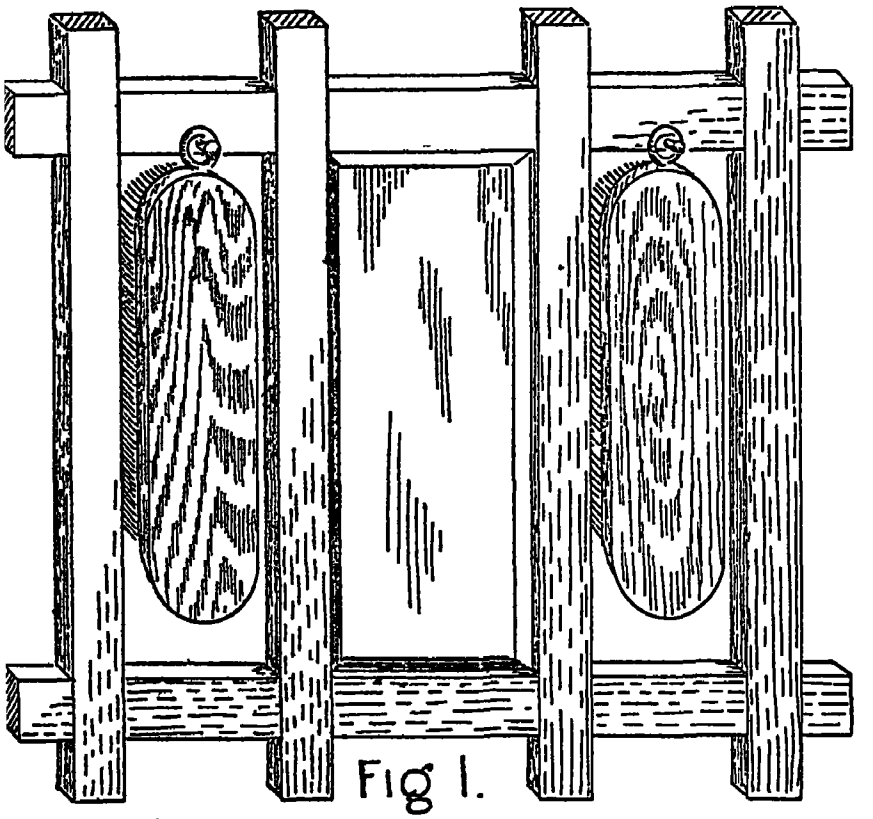
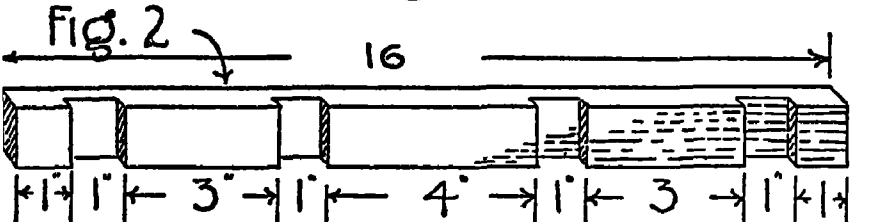


Fig 1.

Fig. 2



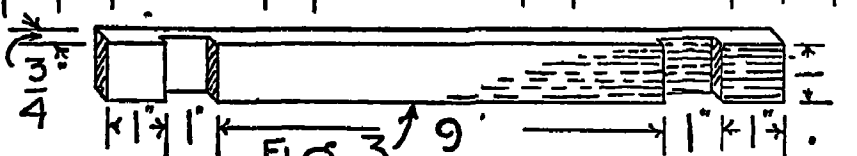


Fig. 3.

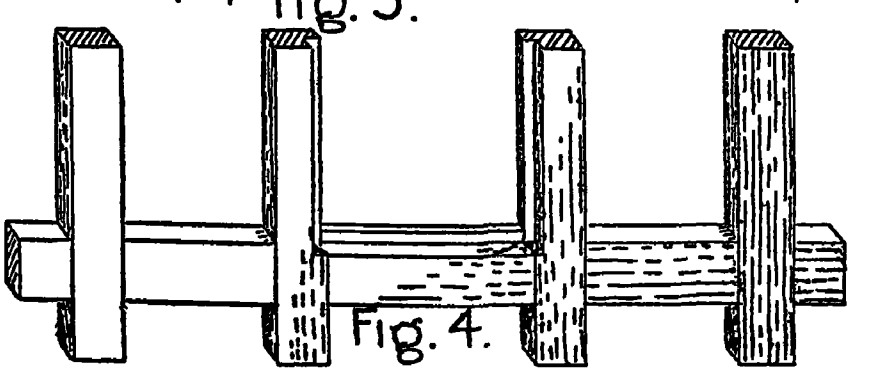


Fig. 4.

A HAT AND COAT RACK

Plane up two lengths to 1 in. by $\frac{5}{8}$ in. and cut to 2 ft. long to allow for waste at the ends. Mark off the pieces, but before setting out the width of the grooves, make quite sure that the wood has been planed to 1 in. wide, if not, mark off the grooves accordingly.

Plane up four pieces to the same size, cut to 13 in. or so long and mark out as shown at Fig. 4. In both cases mark off the lengths that are alike together to avoid mistakes. Cut the grooves carefully with the sawcuts exactly on the waste side of the lines and pare out the waste to the gauge lines which are exactly halfway down.

The wood for the pegs should be planed to $1\frac{1}{4}$ in. by $\frac{5}{8}$ in., as shown at Fig. 5, and then marked out to a pleasing shape. If the ends are 1 in. wide and about $\frac{3}{4}$ in. deep it will do; the sloping portions should be carried within $\frac{1}{2}$ in. or so of the shoulders. The method of cutting the pegs is shown to an enlarged scale at Fig. 6. A shows the first stage in marking, the tenons being about $\frac{1}{2}$ in. thick. Saw the waste out carefully, as indicated at B, and be careful also when cutting down to the notch to work gradually with a chisel. The finished peg is shown at C.

In cutting the mortises or slots for the pegs treat each one separately. Cut as far as possible across the grain to avoid splitting. When the pegs have been fitted, make saw cuts in the tenons and prepare thin wedges, these should not be more than $\frac{1}{8}$ in. thick. Glue the wedges in, and when the glue is hard, trim off the ends with a sharp chisel.

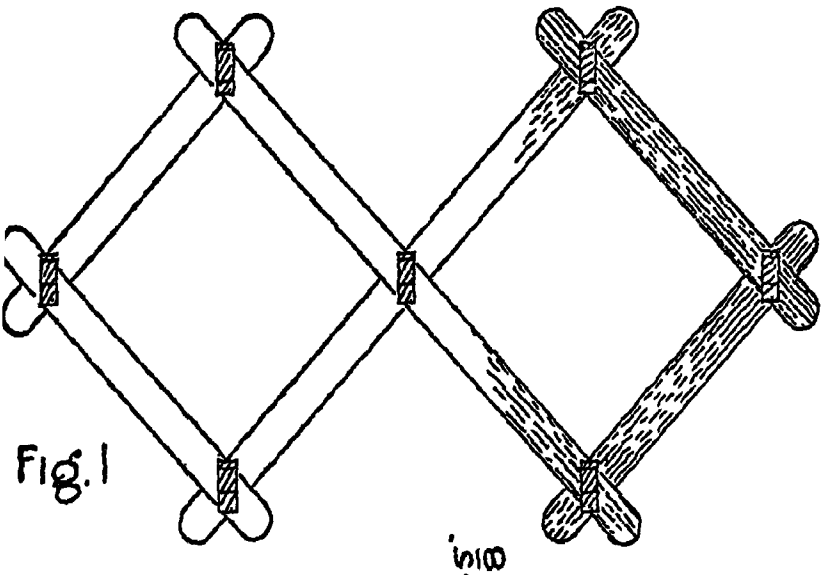


Fig. 1

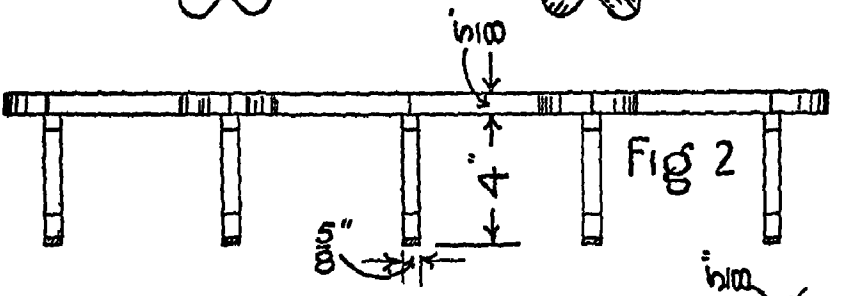


Fig 2

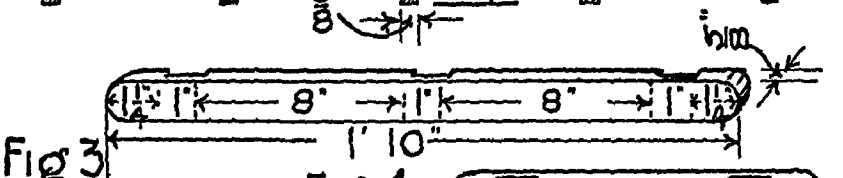
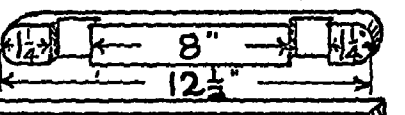


Fig 3

Fig 4



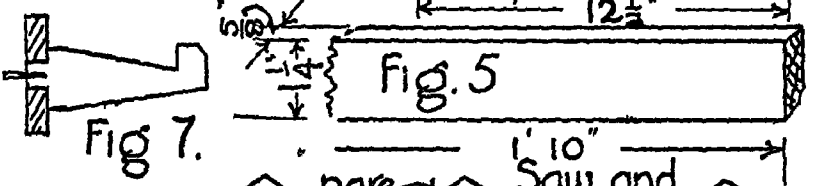


Fig. 5

Fig 7.

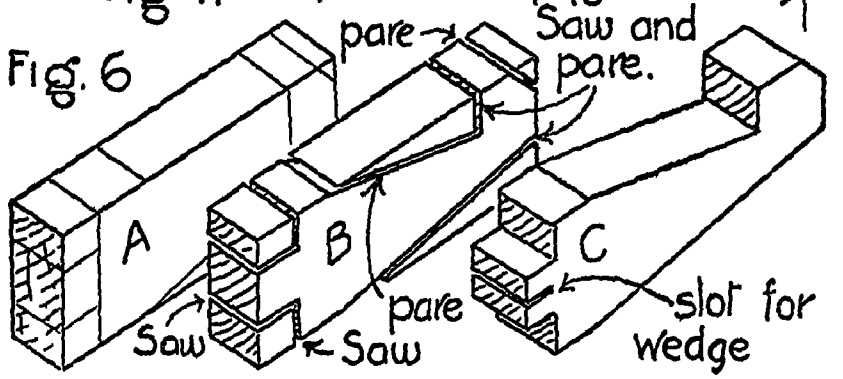


Fig. 6

BOOK RACK FOR THE TABLE

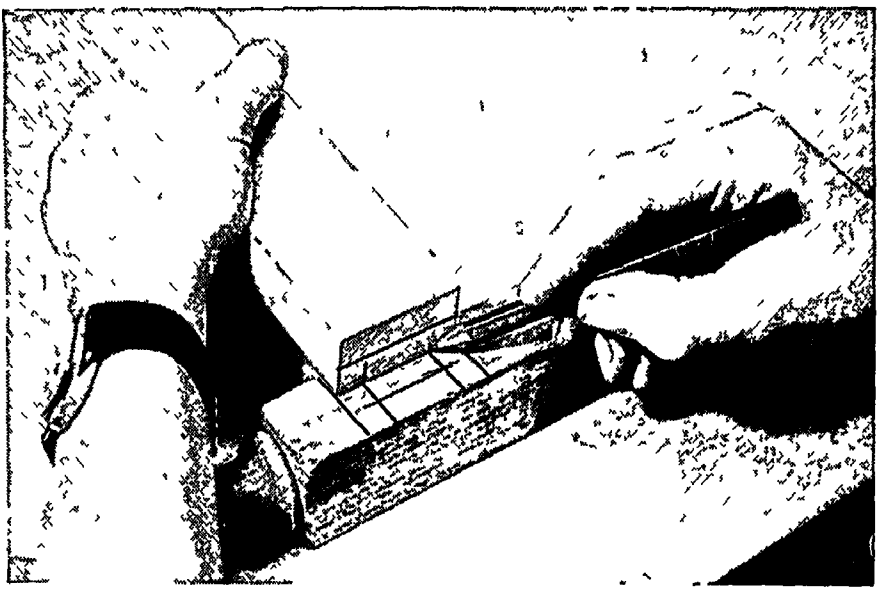
The book rack shown on the next page looks well made in oak with the inlaid pieces ebonised and finished with wax polish.

The dimensions provide for a suitable proportion for the end pieces, but the length can be increased to any convenient size. The actual shape of the end pieces are simple in design and suitable for the inlaid decoration, but the rack itself provides considerable opportunity for variation in contour, and offers a chance for original design.

The end pieces should be planed up carefully to 8 in. by $5\frac{1}{2}$ in. by $\frac{5}{8}$ in., and if possible planed up in one piece. Special care should be taken to keep the edges quite square.

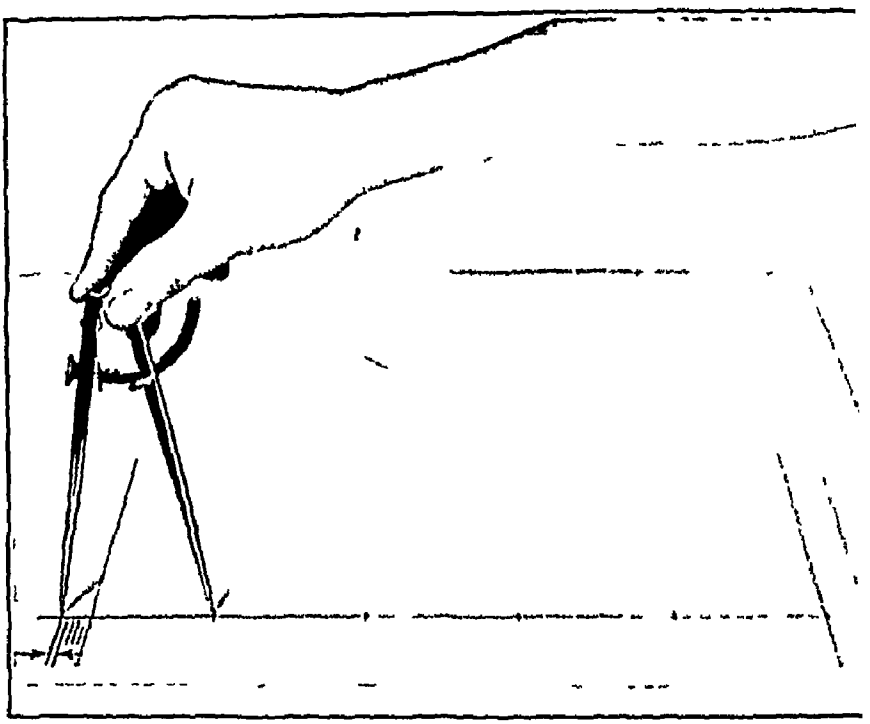
The bottom board and the back strip are dovetailed in, the former being 5 in. wide and $\frac{5}{8}$ in. thick, and the latter 2 in. wide and $\frac{5}{8}$ in. thick. In marking out these pieces, make the distance between the shoulders exactly the same length. The shelf joint is a matter of careful sawing; it is not difficult, but the marking should be done very carefully. The dovetails on the back strips should be marked out and cut so that the sockets on the back of the side pieces can be set out.

Before glueing up the parts, prepare the pieces for the decorative inlay. These should be cut to shape from wood not more than $\frac{1}{8}$ in. thick. If a hardwood such as sycamore is used, the pieces can be stained with ebony stain before being placed in position. Mark out each piece with great care and in cutting the recesses, work across the grain with a sharp chisel. Level the recesses to the depth of the inlay and then glue in position.



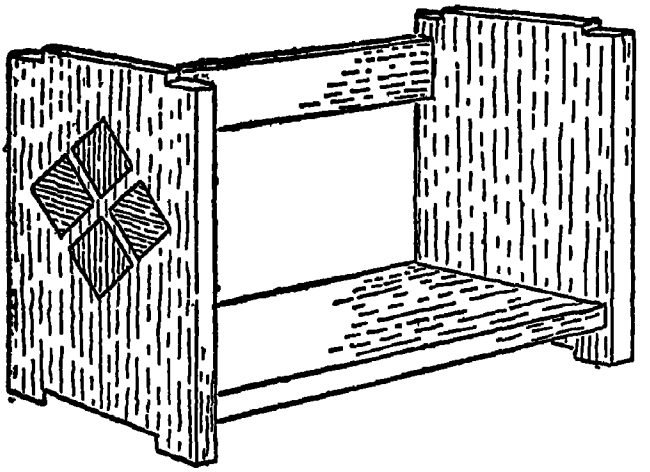
8 MARKING FOR DOWELS

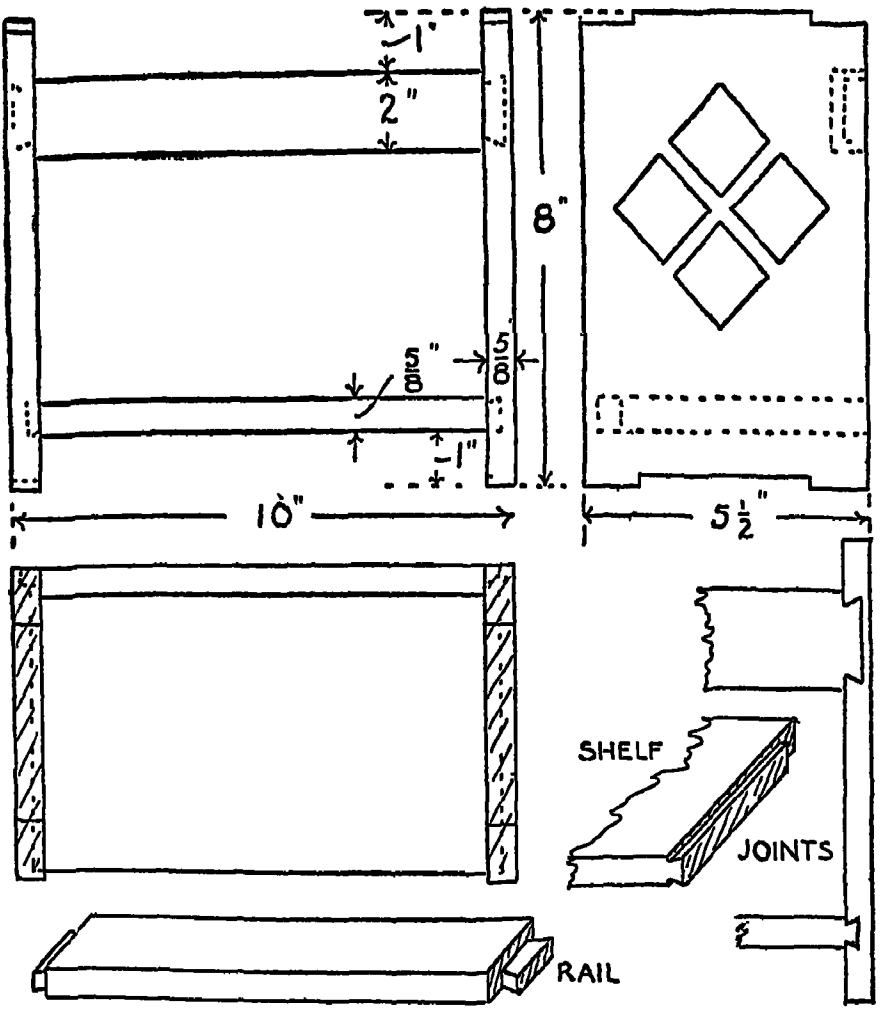
CONSIDERABLE CARE IS NECESSARY WHEN MARKING OUT A DOWEL JOINT A SIMPLE METHOD OF SETTING OUT THE JOINT IS SHOWN ABOVE



9 USING COMPASSES

CARE SHOULD BE TAKEN TO HOLD THE COMPASSES AT THE TOP WITH ONE HAND ONLY COMPASSES ARE USEFUL ALSO AS MEASURING INSTRUMENTS




1"
2"
8"
.5"
.5"
1"
10"
5½"
SHELF
JOINTS
RAIL

EASILY MADE HANGING BOOKSHELVES

The design at Fig. 1 can be made from any wood prepared to 6 in. wide and $\frac{5}{8}$ in. thick, and if the material can be obtained machine planed, it is a piece of work that is suitable to make up at home with a few tools. The dimensions given provide for a bookshelf of a convenient size.

If the wood is machine planed, the width will work out a little less than 6 in. and about $\frac{5}{8}$ in. thick for $\frac{3}{4}$ in. board. Care should therefore be taken in marking out the two side pieces, as shown at Fig. 2, to make the grooves equal in width to the exact thickness of the wood.

The top piece should project at least to the amount shown at Fig. 3. The four shelves should be marked exactly to the same length and are let in $\frac{1}{4}$ in. deep.

The cupboard door, as shown at Fig. 5, should be fitted in the space after the shelves have been glued in, the two end pieces are necessary to stiffen the wood and prevent warping.

A small cupboard lock, which costs very little, should be provided as shown at Fig. 6. A neatly cut recess will be required inside as well as on the top edge of the door, the shape of the recess will be similar to that shown at Fig. 7, but considerable care will be necessary to make a good fit. The best way is to make the hole for the key and then cut the inner recess before dealing with the recess for the back plate. Hinge the door with brass butts and provide large mirror plates so that the shelves can hang securely. If necessary a plywood back can be fitted to the back of the cupboard.

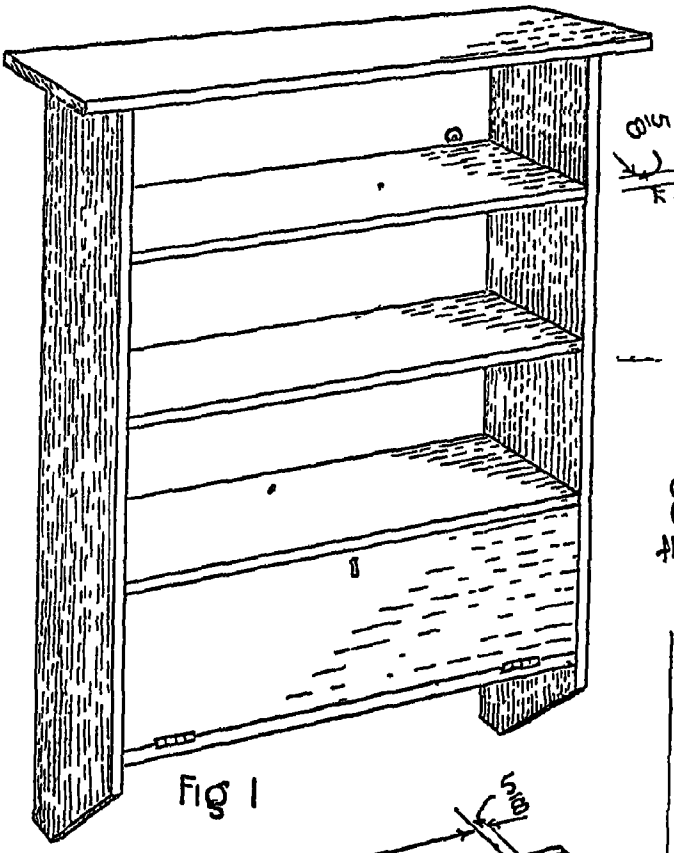


Fig 1

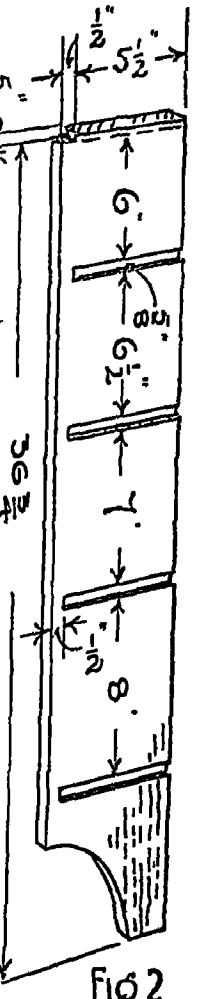


Fig 2

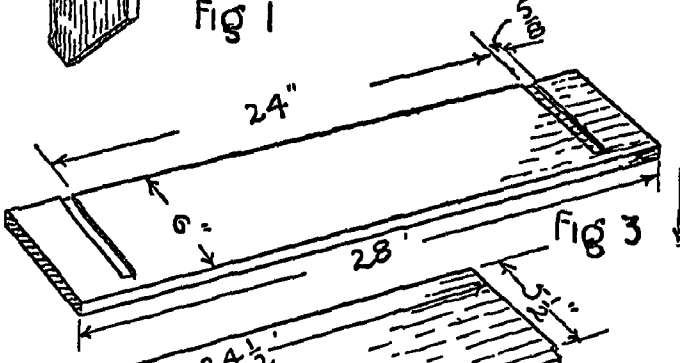


Fig 3

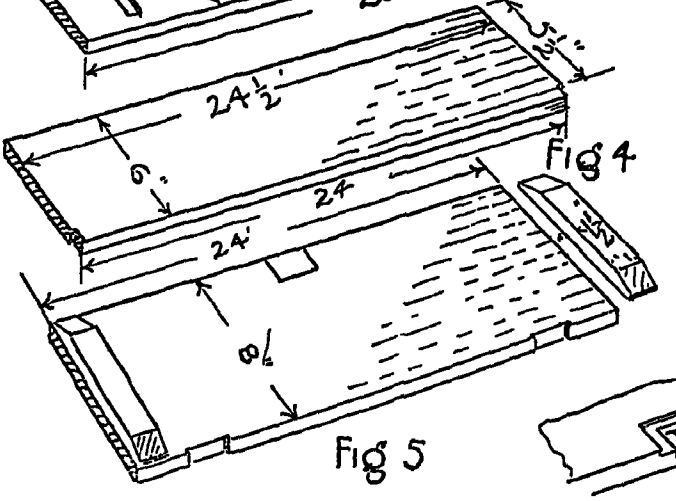


Fig 4

Fig 5



Fig 8

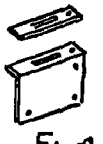


Fig 6

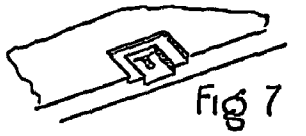


Fig 7

A KNIFE BOX

The knife box shown on the next page is interesting in design as it is composed of straight lines.

Although it can be made quite easily in whitewood or pine, a much more satisfactory job will result if oak is used.

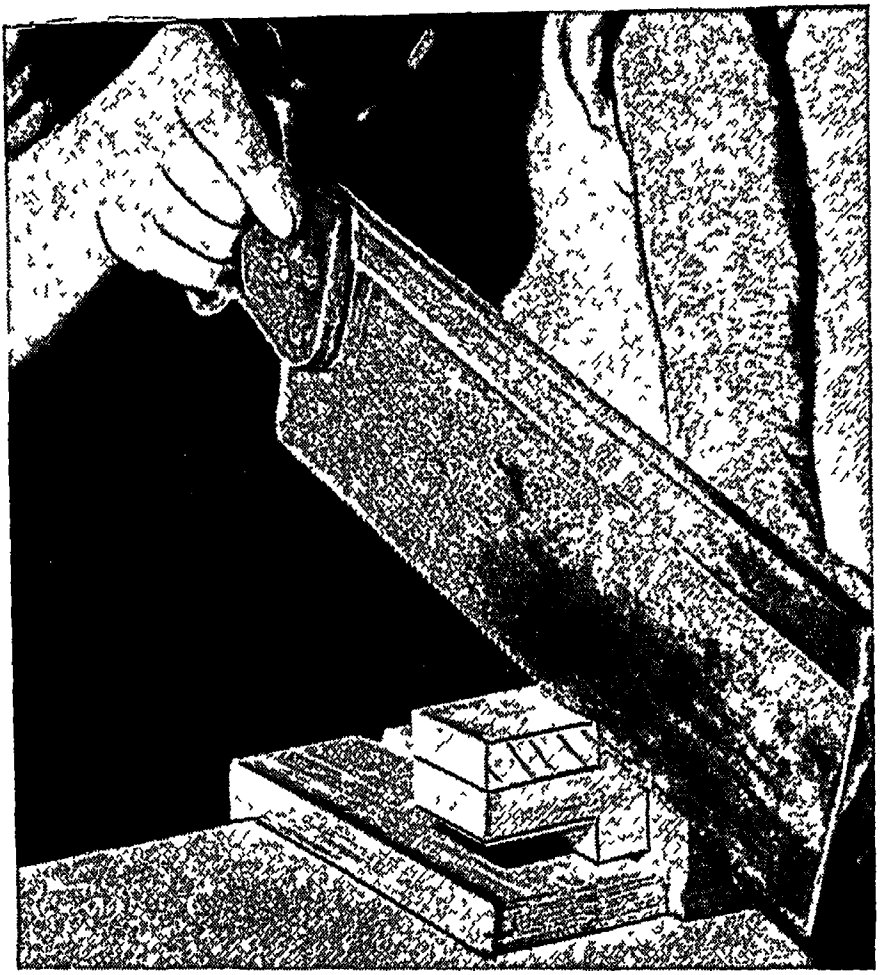
The dimensions are given in the plan and elevations and the details of the parts.

The two side pieces are 13¼ in. long and 2½ in. wide, but the end pieces should be 9 in. long and 2⅜ in. wide. A separate detail is given for the dovetail joint at the corners. The proportions given for the centre and the two half pins should be kept to as closely as possible. It should be noted that the dimensions given for the sides and ends are finished sizes, some allowance, at least ⅛ in., must be made at each end for waste to be cleaned off after the dovetail joints have been glued up.

The centre partition is prepared to 13½ in. by 3⅞ in. by ⅜ in., marked out as shown in the separate detail. The slot can be made by cutting out holes with a ⅞ in. centre bit and trueing up with a sharp chisel. It will be seen that the ends of the partition are fitted in grooves with a portion tenoned right through the end pieces.

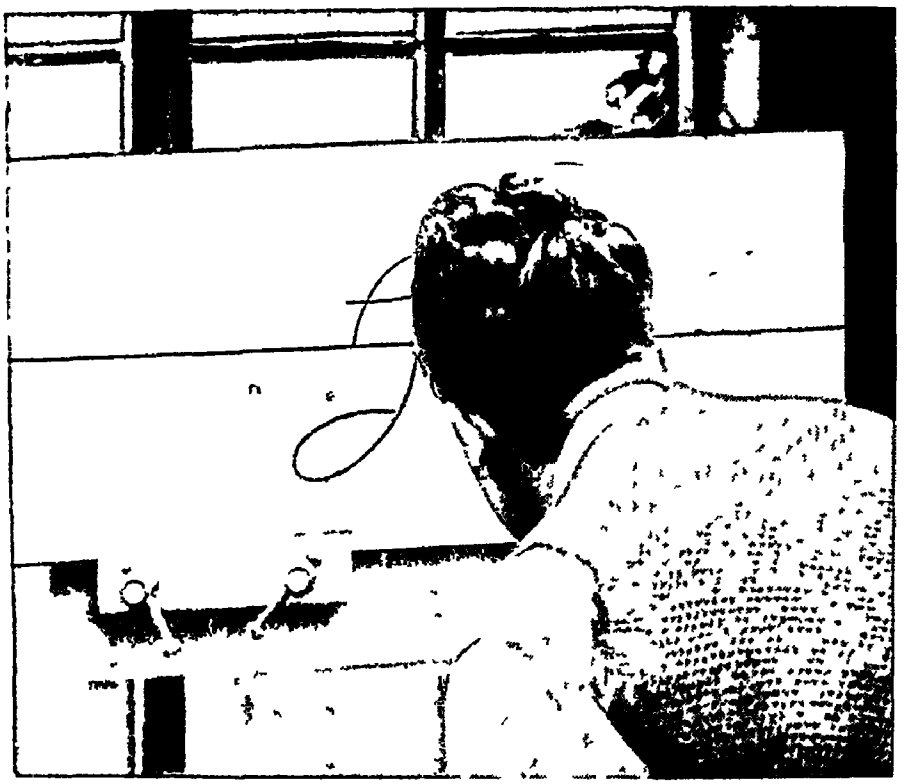
The overlay pieces at the end should be cut to the shape shown in the detail and glued in position. The bottom of the box is prepared to 15 in. by 9½ in. by ¼ in.; it may be of thin board, but a piece of plywood can be used.

Some care should be taken in finishing to leave all edges smooth and true, particularly on the end grain. A wax finish is suggested.



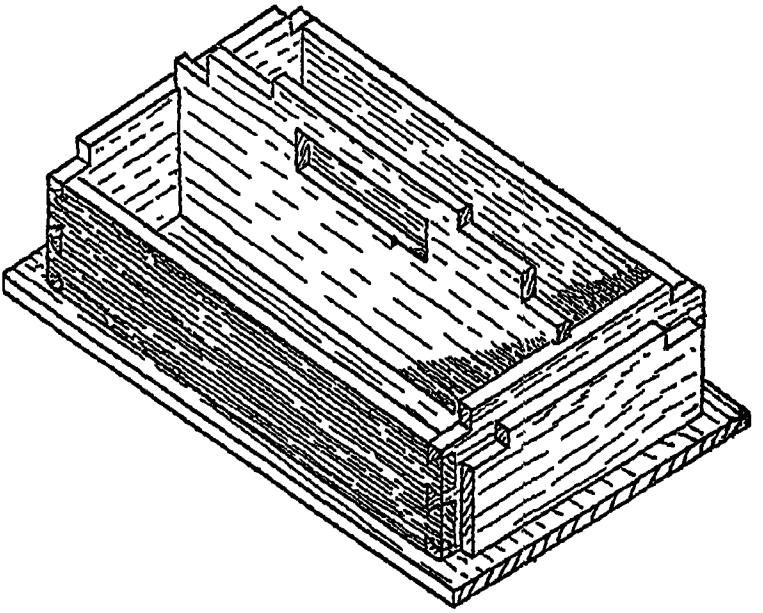
10 HOLDING THE TENON SAW

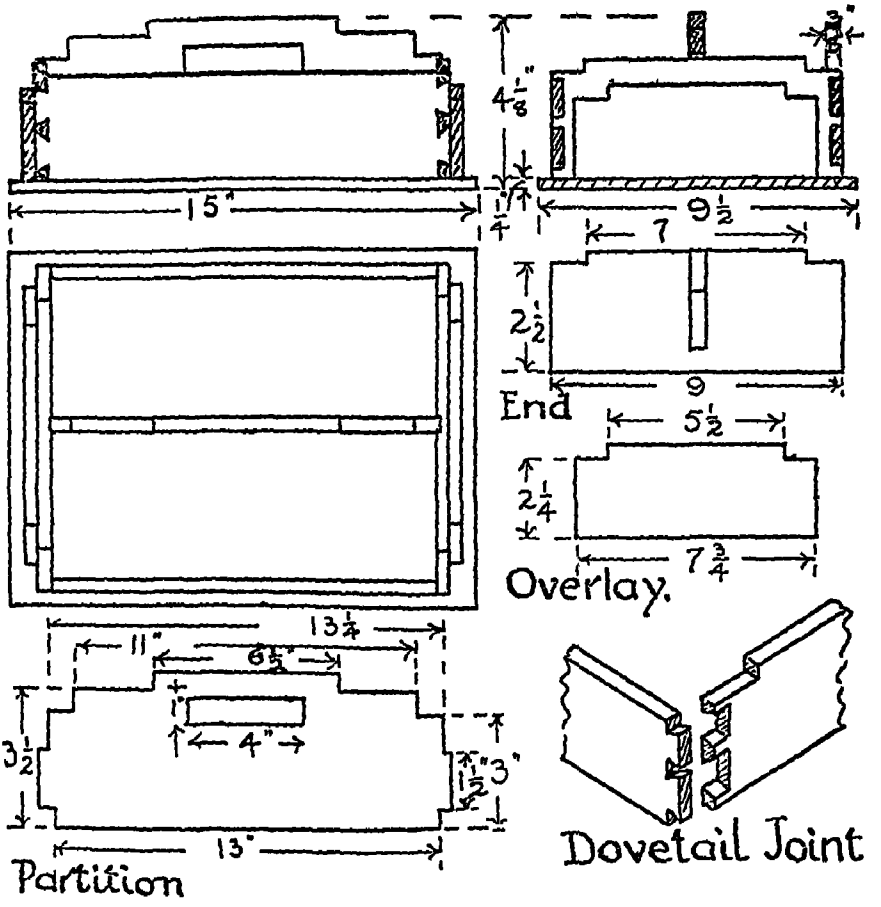
WHEN COMMENCING THE CUT INCLINE THE SAW AND GRADUALLY BRING IT LEVEL DO NOT FORCE THE SAW



11 TESTING A PLANED JOINT

PLACE THE FACE EDGES TOGETHER IN FRONT OF A WINDOW IF THE JOINT IS TRUE, NO LIGHT SHOULD BE VISIBLE BETWEEN THE TWO PIECES




4⅛"
15"
1¼
9½
7
2½
9
End
5½
2¼
7¾
Overlay.
13¼
11"
6½"
4"
3½
1½
3"
13"
Partition
Dovetail Joint

FOLDING PLATE RACK

First of all obtain some wood, either finished to a thickness of 1 in. or plane it down to 1 in. thick. Two lengths of 24½ in. and two of 9 in. will be required. Prepare the long lengths to 1¾ in. wide, and mark off a little waste at one end of each piece. Set out a distance of 24 in. and saw off the waste, leaving just sufficient beyond the saw cut to enable a clean chisel cut to be made, the ends should be left quite smooth.

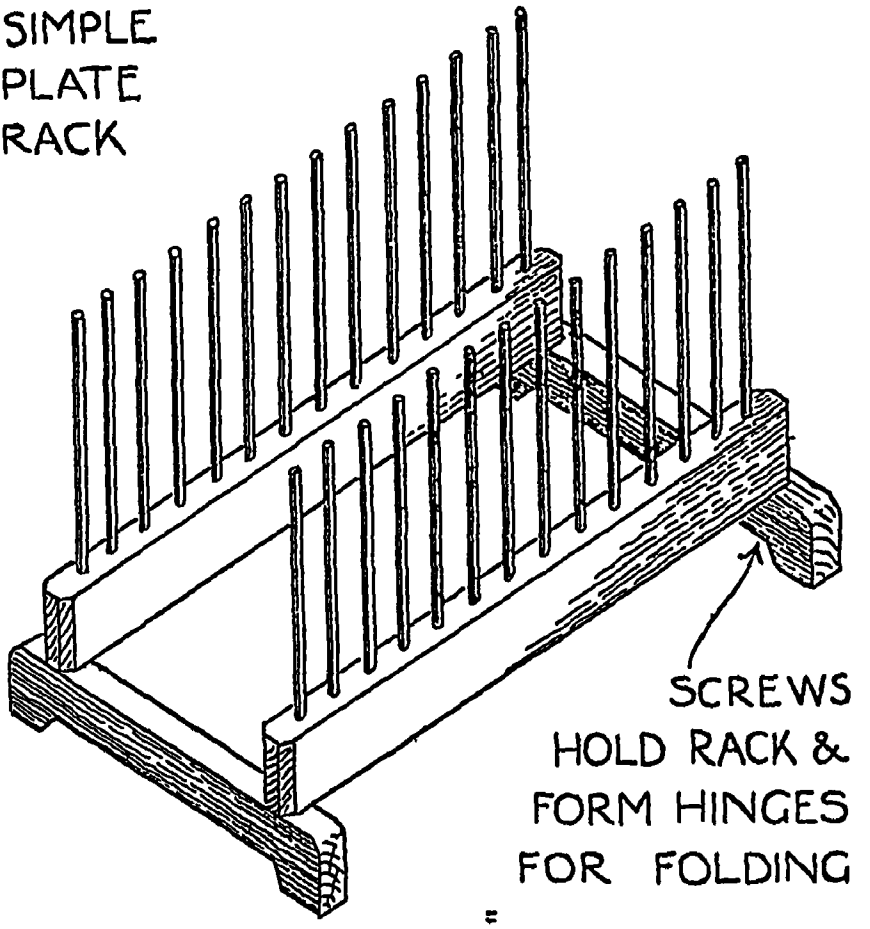
Draw a pencil line along the top edge of each length and set out an equal number of spaces. It will be found that fifteen spaces just under 1⅝ in. will work out evenly.

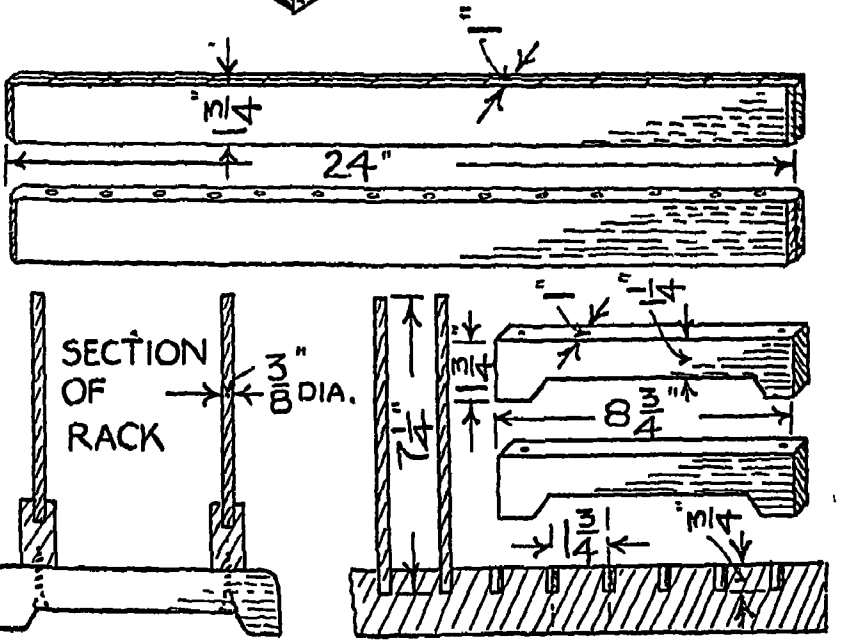
The next job is to obtain a centre bit which will make a hole exactly the same diameter as the ⅜ in. diameter dowelling. It will not do to have the holes too large, and if the bit bores a hole slightly smaller, it should be used in preference to one making a larger hole. Bore the holes to an even depth of ¾ in.

Now provide the two feet; they are planed down to 1¾ in. and finished in the same way as the long pieces to 8¾ in. Mark off ½ in. from the bottom edges, set out a distance of 1 in. from the ends, draw a sloping line and then saw out the waste. Bore holes about 1¼ in. or so vertically through the two pieces at each end and then round the ends neatly with a sharp chisel.

To finish the rack, fit the dowelling in the holes. If necessary glasspaper the ends to obtain a tight fit, then push the dowels in position, first brushing on some glue. Finally screw the feet on to the long lengths.

SIMPLE PLATE RACK





A CORNER BRACKET

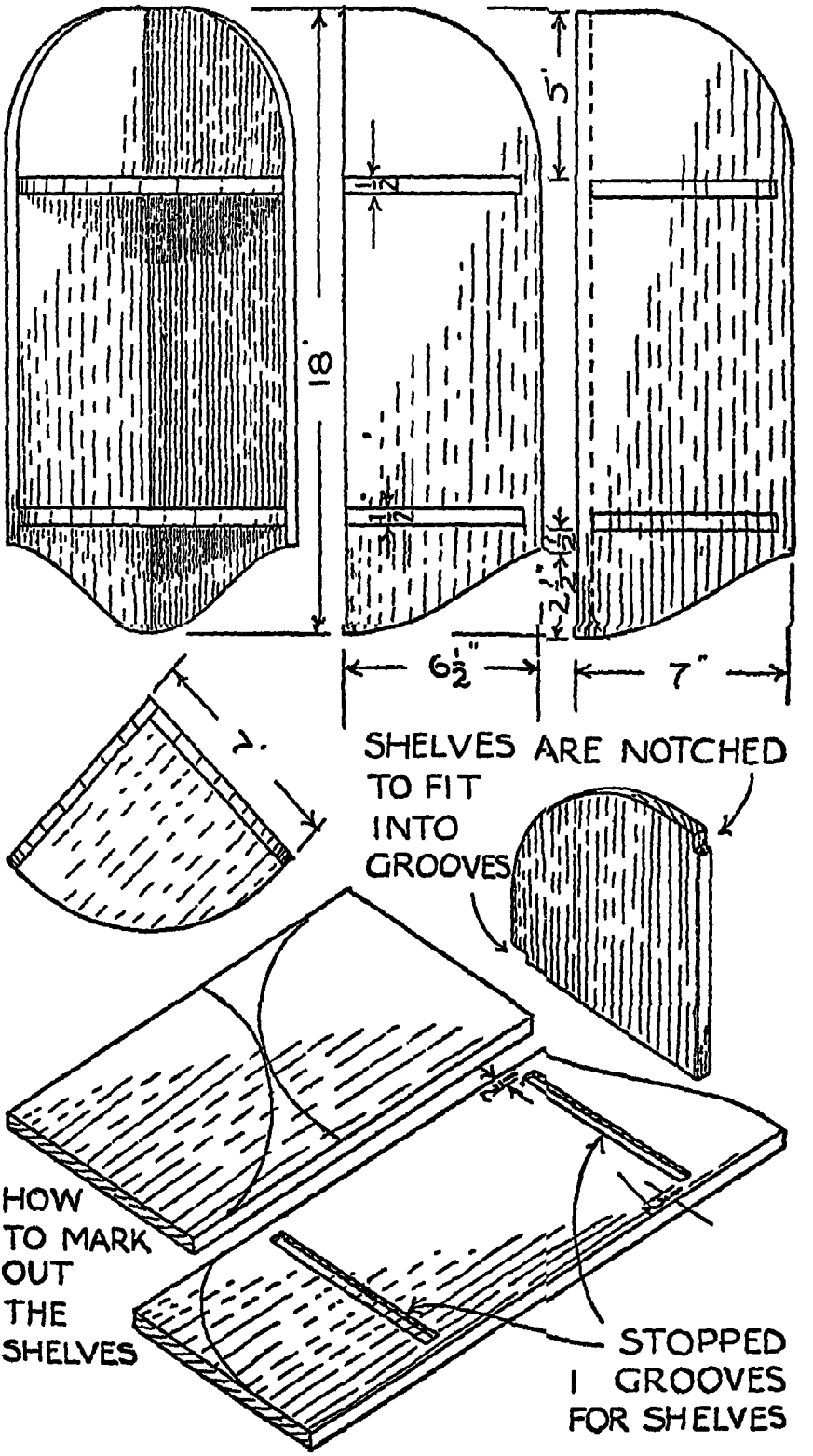
The useful corner bracket shown on the next page can be made from $\frac{1}{2}$ in. or $\frac{5}{8}$ in. wood to any reasonable size. A convenient set of dimensions would be 18 in. long by 7 in. wide, but these dimensions can easily be altered so long as the main proportions are retained.

The bracket can be made in oak or whitewood, and if made to the given dimensions, cut off two lengths, a little over 18 in. long; one piece to be planed down to 7 in. and the other to $6\frac{1}{2}$ in.

The next job is to mark out the stopped grooves; they are $\frac{1}{2}$ in. wide, or the exact thickness of the wood to be used for the shelves. The top groove is marked 5 in. down from the top, and the lower groove $2\frac{1}{2}$ in. up from the bottom. On both pieces the grooves are stopped within $\frac{1}{2}$ in. from the front; on the wider piece, the same distance from the back, although the groove can be carried right through as it will not be seen.

The curved shape at the top and the bottom should, if possible, be sawn with a bowsaw, but the shapes can be sawn as closely as possible with a tenon saw, and then finished with chisel, gouge and spokeshave. Care should be taken to keep all edges square, use the try square frequently during the process of finishing.

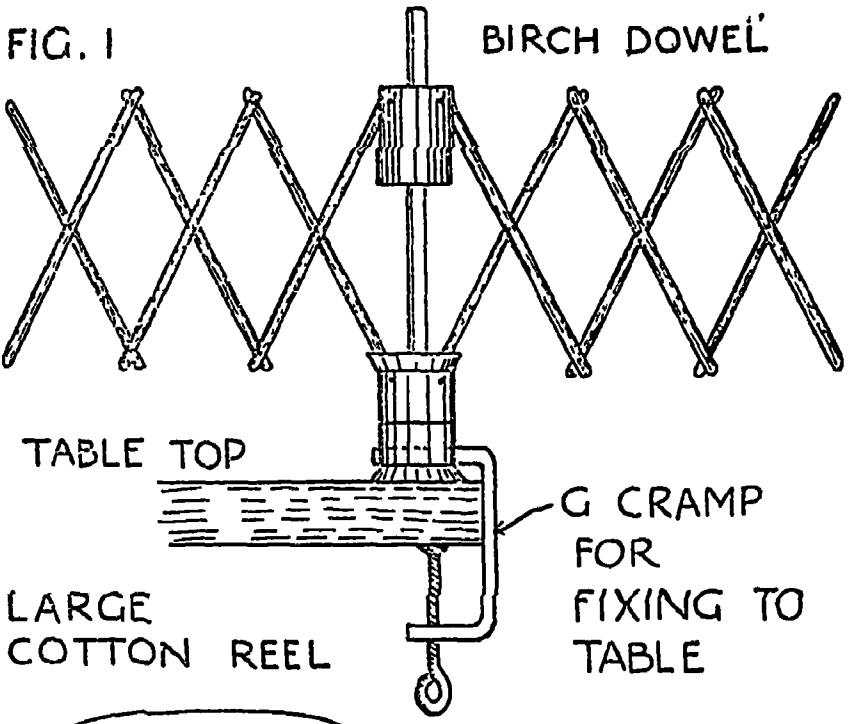
The shelves should be marked out on one piece of wood as shown in the separate diagram. Plane up the wood to 7 in. by $\frac{1}{2}$ in., and strike the curves with a pair of compasses. Saw out to shape and finish as carefully as possible with a spokeshave. The edges of the two shelves are notched $\frac{1}{2}$ in. along and $\frac{1}{4}$ in. down.


18"
5"
1"
1"
2½"
2½"
6½"
7"
2"
SHELVES ARE NOTCHED TO FIT INTO GROOVES
HOW TO MARK OUT THE SHELVES
STOPPED GROOVES FOR SHELVES

A WINDER FOR WOOL

The materials required are a large cotton reel, another smaller, a length of dowel rod, from 7 in. to 8 in. long, 24 lengths of 6 in. by $\frac{1}{2}$ in. by $\frac{1}{8}$ in. wood, a small G cramp and some wire nails. The smaller reel should be fitted on the rod so that it is an easy fit, it is then sawn top and bottom as at Fig. 2. The sides are divided into four equal parts, the line forming the centre of $\frac{1}{8}$ in. grooves which are carried down as deep as possible without reaching the middle hole. The method of treating the larger reel is shown at Fig. 3. First of all measure the end of the cramp, and then provide a twist drill of the same diameter as the thickness of the cramp. The width of the end of the cramp is marked on the reel and holes are drilled at these points right through the wood. One or more holes should be drilled between to remove as much of the waste as possible, then clean out the slot with a chisel. The upper portion of the reel is slotted as indicated. The strips of thin wood should be made smooth with glasspaper and the ends slightly rounded and then the holes as at Fig. 4 drilled with a fine twist drill. The pieces fitting in the middle should have holes at both ends. Four sets of trellis formation are made, small wire nails being used as rivets and cut to the length with pliers. The ends of the strips which are to fit in the centre should be trimmed off and each fitted in turn in the slots. Considerable care should be taken in fitting the trellis, suitable holes being made with a fine drill, and fine wire nails driven in. The rod is now secured to the bottom reel with glue.

FIG. 1



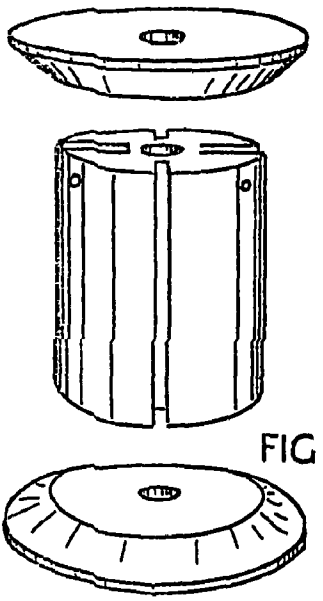


FIG 2.

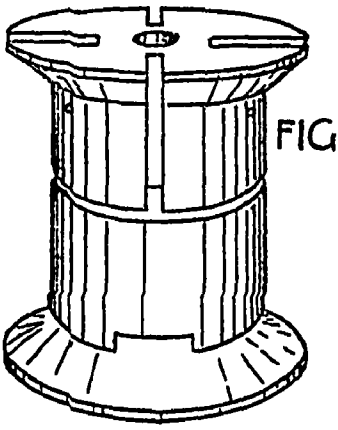
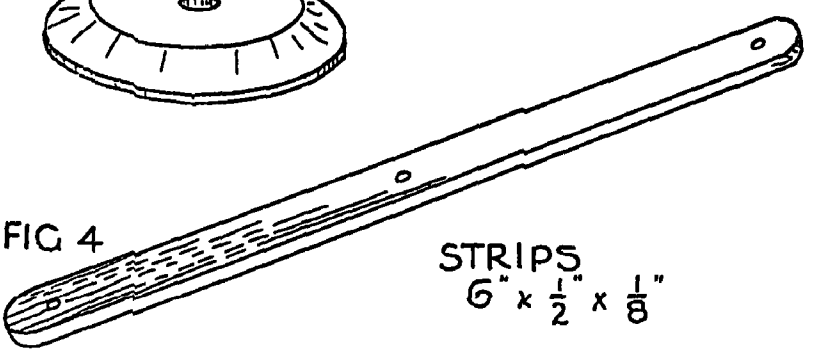


FIG 3



A USEFUL STOOL

The material required is a length of planed board, 9½ in. by ¾ in. The top A, measures 15 in. by 9½ in., and is grooved to take the legs, B, C. These are 9½ in. long, and as they slope outwards it will be necessary to make the grooves to suit. The distance from the end should be about 2½ in. and to obtain the correct slope of the grooves a bevel should be set to the correct angle; this can be obtained from a full size drawing. The saw should be used at an angle to correspond with the slope.

The legs should be cut off top and bottom to the corresponding angle and the curved hollow at the bottom marked out, sawn with a bow saw and finished with a spokeshave. The slot for the stretcher must be left until the material has been prepared and it will be found that a 15 in. length of the wood will cut out two 2½ in. wide pieces for the sides D and E, and leave a strip for the stretcher F. The tenon on the end should be full width and ⅜ in. thick. The slot in each leg can now be marked out and cut to these dimensions.

The next stage is to plane the two side pieces to 3 in. wide and shape the ends with a hollow curve as shown at D and E.

When all parts are made, they should be cleaned up with glasspaper.

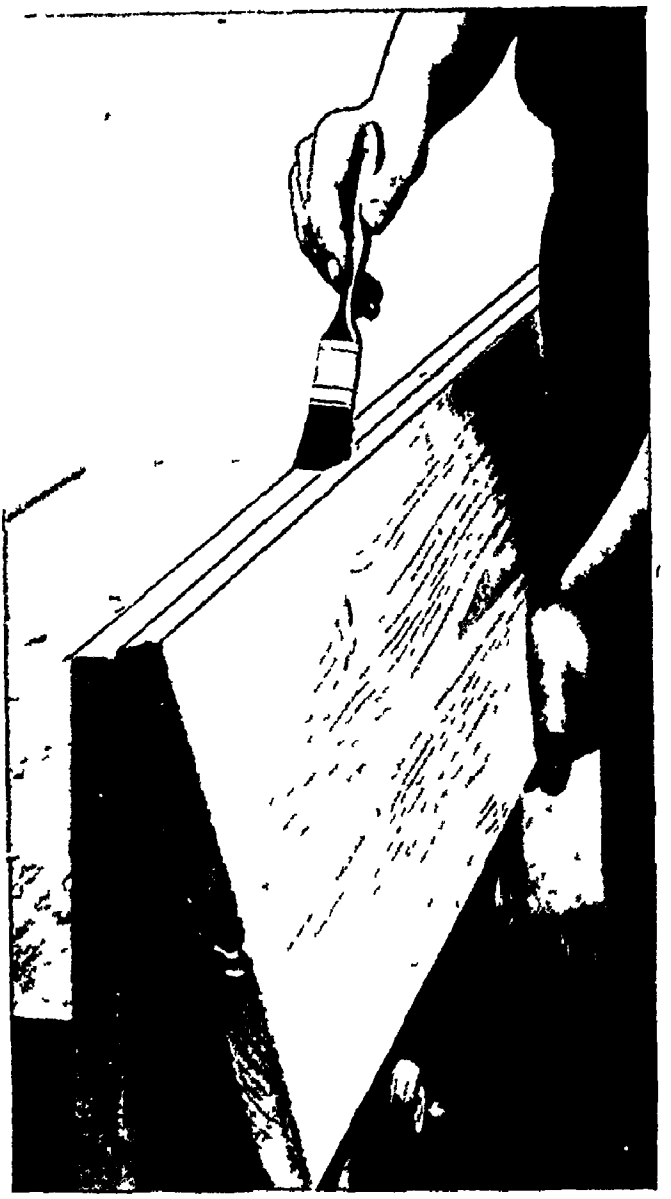
The legs should be placed into the groove, the stretcher fitted in and the side pieces attached to the top first with either screws or nails.

The stretcher can now be wedged up tight, but care must be taken not to tighten it up too much or the end of the tenon will split.



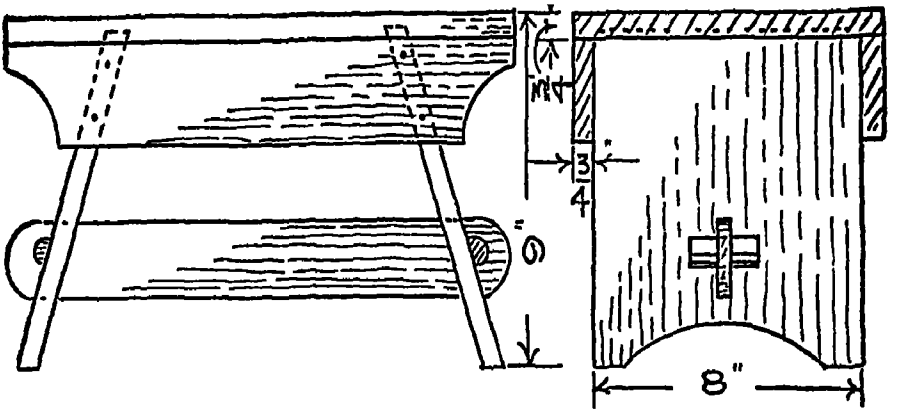
12 GLUEING A PLANED JOINT

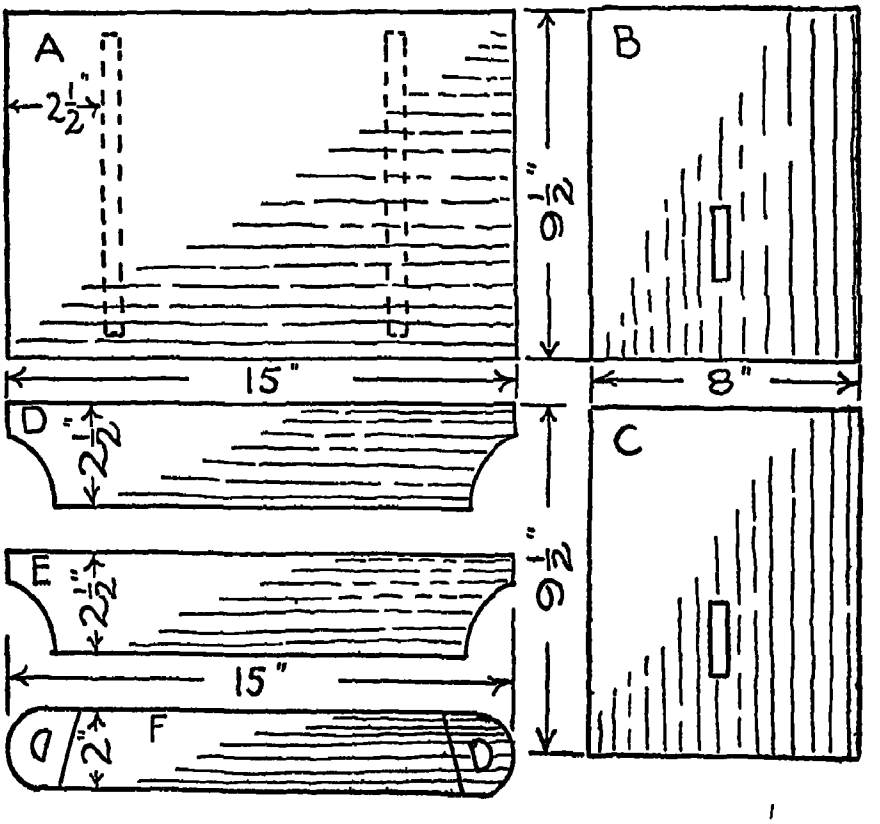
AFTER THE EDGES HAVE BEEN PLANED TRUE AND TESTED, APPLY THE GLUE AND THEN RUB THE BOARDS BACKWARDS AND FORWARDS TO EXCLUDE ALL SURPLUS GLUE

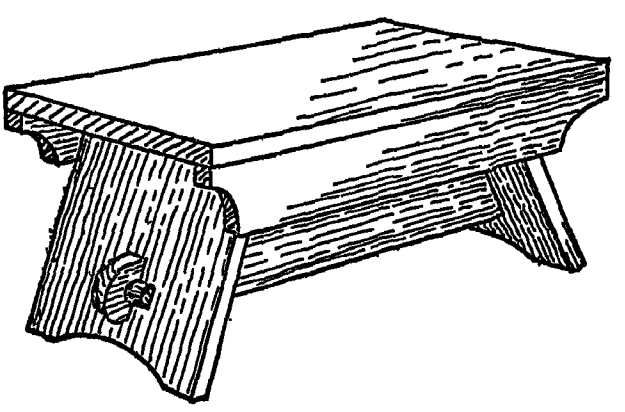


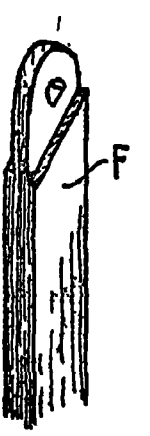
13 GLUEING A LONG JOINT

BE CAREFUL TO USE STRONG BUT THIN GLUE SPREAD IT TO FORM AN EVEN FILM AS THINLY AS POSSIBLE REMEMBERING THAT A LOT OF IT WILL BE SQUEEZED OUT AFTERWARDS


3/4
6"
8"


A
2 1/2"
9 1/2"
15"
B
8"
D
2 1/2"
C
E
2 1/2"
9 1/2"
15"
2"
F




F

SIMPLE ARTICLES IN PLYWOOD

There are many useful little articles which may be made from plywood, and odd pieces left from larger work should be placed on one side to use up later.

A handy little match stand can be made to the design shown at Fig. 1. The base should be about 3 in. square, it is made from two pieces, the upper piece being $2\frac{1}{2}$ in. square. Glue the two pieces together to leave a rebate of $\frac{1}{4}$ in. on all sides, as shown in the section at Fig. 2. This rebate can be filled with $\frac{1}{4}$-round ball beading, or with a hollow beading as at Fig. 3. The case for the box should be made to fit an ordinary matchbox, but if desired, the case can be omitted and the matchbox fitted on a small block screwed to the base.

The stand for cotton reels as shown at Fig. 4 is another useful article. Birch dowels should be used for the uprights, which should be fitted in holes bored in the top piece and glued up. The ball beaded edging forms a suitable finish.

A stand for eggs as shown at Fig. 5 is also made with thin plywood, with dowelling to form a support for the top. The shape should be drawn out full size on a piece of paper so that the position of the holes can be marked out. A usual diameter for the holes is $1\frac{1}{4}$ in. The space between the holes should be at least $\frac{1}{4}$ in., but may, with advantage, be a little more. The base should be about 1 in. below the top and can be made to the same diameter as the top or a little larger.

The dowel supports can be secured with screws, but it is better to let them in about $\frac{1}{8}$ in.; holes should be bored with a suitable centre-bit.

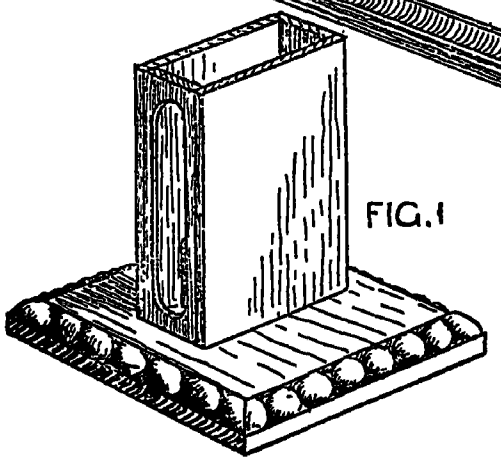


FIG. 1

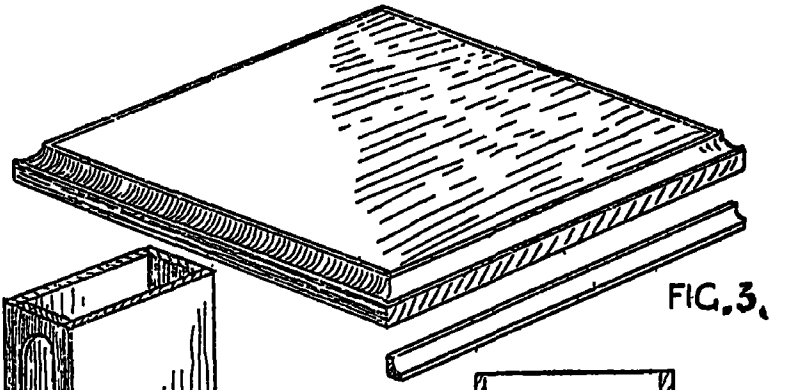


FIG. 3.

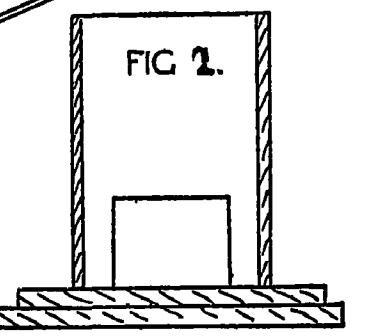


FIG 2.

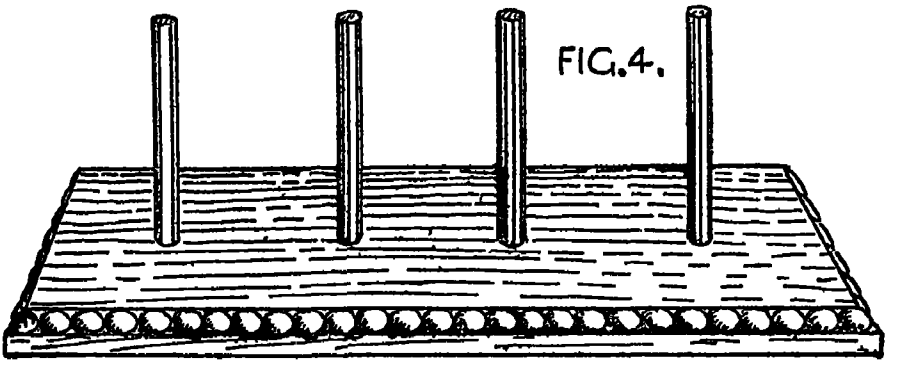


FIG. 4.

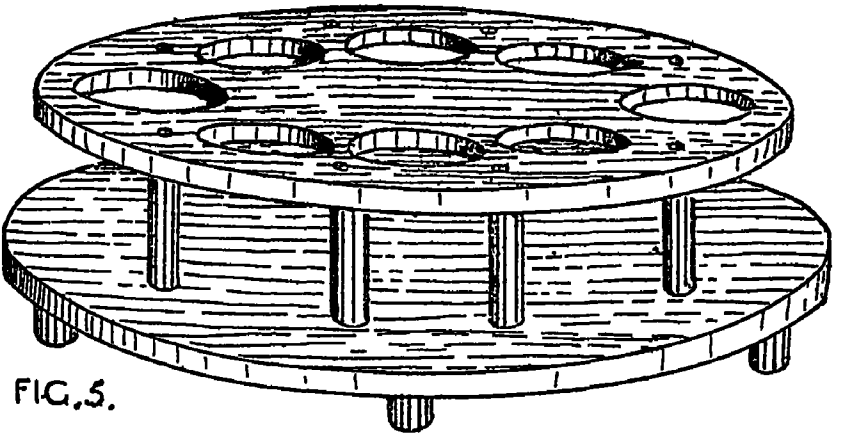


FIG. 5.

BOOKSHELF

The standing bookshelf shown on the next page is a design suitable for the boy who is fairly advanced in the craft of woodworking.

For the sides and shelves, obtain an 8 ft. 6 in. length of machine planed oak, 9 in. by $\frac{3}{4}$ in.

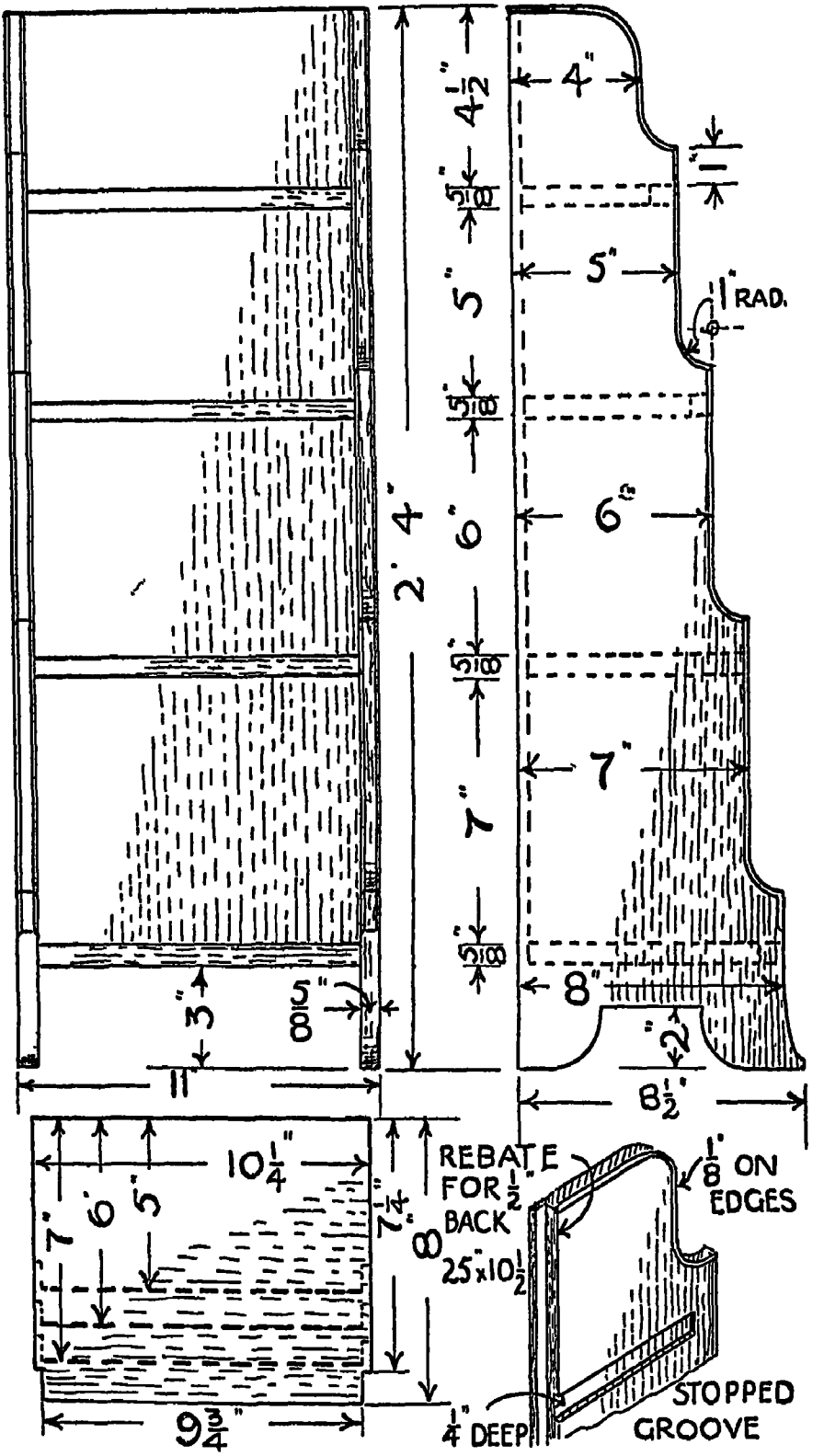
Cut off the two sides to 2 ft. $4\frac{1}{2}$ in. long, and set out the shape as shown in the side view. Begin by setting off $\frac{1}{4}$ in. waste at the top, and then mark off the first groove. Do not take the $\frac{5}{8}$ in. measurement as correct, but measure the wood.

Continue with the other measurements as indicated and then cut the grooves to the correct length. The shaped front edge must be cut out with a bow-saw and finished with a spokeshave. Finally work the chamfers where shown.

Plane a rebate on the inside back edges of both uprights and provide a back of $\frac{1}{2}$ in. wood. Plywood could be used, but the thicker wood is more suitable.

Prepare the four shelves to the correct widths, all are $10\frac{1}{4}$ in. in length, the top one is 5 in. wide, the next 6 in., the next 7 in., and the bottom one 8 in. wide; the latter is notched on the front edges to leave a distance of $9\frac{3}{4}$ in.

Glue in the shelves and if they are a correct fit, no other means of securing them should be needed. If they should be loose, it will be necessary to brad them in from the sides; the holes formed by the nail heads being filled in with plastic wood. Screw on the back piece to the sides and then clean up and finish with wax polish, rubbing it in thoroughly with a hard brush.


2'4"
4½"
5/16"
5"
5/16"
6"
5/16"
7"
5/16"
4"
1"
5"
1" RAD.
6"
7"
8"
2"
3"
5/8"
11
8½"
10¼"
6"
5"
7"
7¼"
8"
9¾"
REBATE FOR ½" BACK
25"x10½"
⅛" ON EDGES
¼" DEEP
STOPPED GROOVE

A FIREPLACE SCREEN

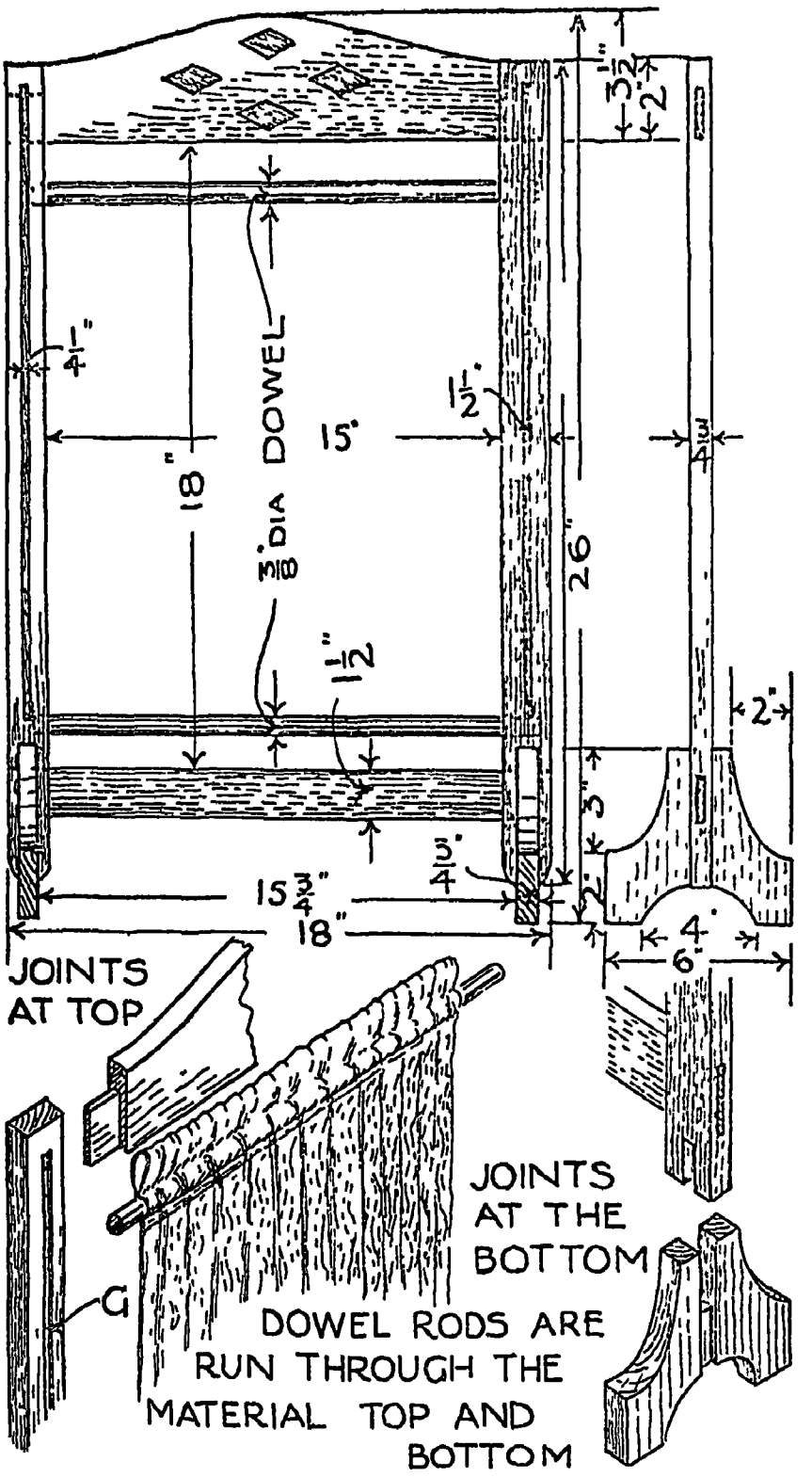
There is a difference between a fire screen and a fireplace screen, although it is usual to term all fitments made for placing in front of the fireplace, fire screens. The fire-place screen is used in summer to form a decorative feature in front of the grate and to hide the empty space.

There are innumerable designs to be seen in the furniture shops, and they may suggest suitable adaptions that may easily be carried out by the ingenious boy.

The design shown on the next page is not difficult to make and consists of a framework decorated on the front and filled in with some suitable material which is run on dowel rods fitted in holes in the framing.

All the necessary dimensions are given in the diagram together with details of the joints at the top and bottom. The mortise and tenon joints are quite straightforward and will offer no difficulty to the boy who has already made a few similar joints. Before the joints are glued up, the holes for the dowelling should be bored to fit On one side, carry the holes to a depth of $\frac{1}{2}$ in., and on the other to a depth of 1 in., this will allow of 16 in. lengths of dowelling to be used. Push them in the 1 in. deep hole first, when fixing the material in place.

The simple pieces of inlay should be carried out in a contrasting wood, or sycamore can be used and stained with ebony stain. The lines for the upright banding of the same material as the top inlay should be made with a sharp edge on the marking gauge and cut out with a narrow chisel.


1¼"
3/8" DIA DOWEL
15"
18"
1½"
1½"
26"
3½"
2"
2"
3"
2"
¾"
15¾"
18"
4"
6"
JOINTS AT TOP
JOINTS AT THE BOTTOM
DOWEL RODS ARE RUN THROUGH THE MATERIAL TOP AND BOTTOM

BOOK ENDS FROM SCRAP PIECES

Book ends can be easily made from small pieces of wood. The design at Fig. 1 illustrates a method of using triangular pieces of wood. The direction of the grain should be vertical, as at Fig. 1. If in different directions, as at Fig. 2, finish the work with enamel or cellulose paint.

With an equilateral shape, the sides should be from 4½ in. to 7 in. long and the thickness from ¾ in. to 1 in. The middle one of the three pieces should be about 4½ in., and the other two pieces say 1 in. larger and 1 in. smaller.

A piece of tinned sheet, as at Fig. 3, 4½ in. wide and 6 in. long, forms the base of the support.

The metal plate should be painted before being screwed on and the wood sized after staining and before varnishing.

Another useful design is shown at Fig. 4. The large triangle should be about 6 in. wide and at least 9 in. long. The two pieces of wood, as shown at Fig. 5, should be screwed together, the smaller piece being of the same shape as a 60° set square.

An effective yet simple design is shown at Fig. 6; this uses a little more wood and takes longer to make, but it looks very well when finished. The main upright, measuring about 7½ in. by 6 in., as shown at Fig. 7, is prepared by making three saw cuts each side to form the steps. The triangular pieces should be stepped down in the same proportion as the sides. These pieces should be glued together and then screwed to the uprights. It is advisable to make the metal plate long enough to cover the triangular pieces as in Fig. 4, and trim the ends close to the wood.

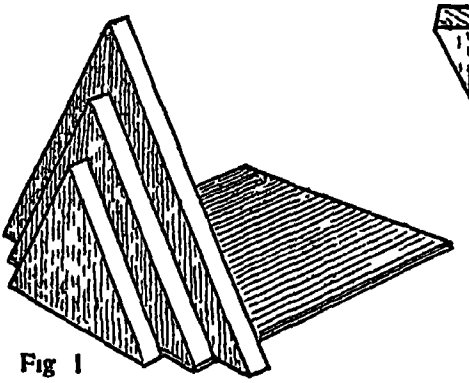


Fig 1

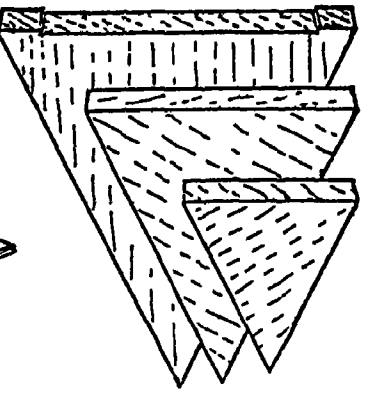


Fig 2

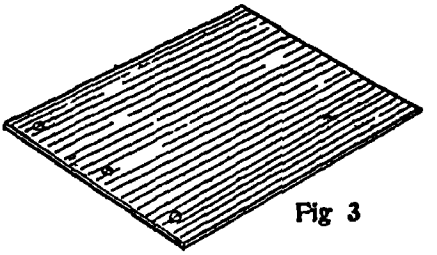


Fig 3

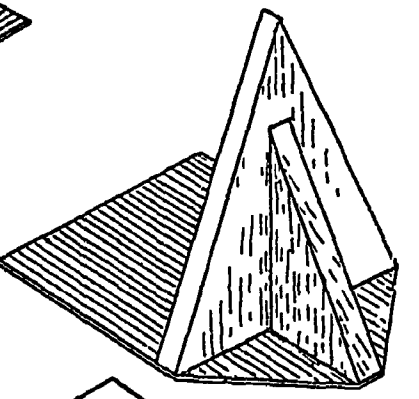


Fig 4

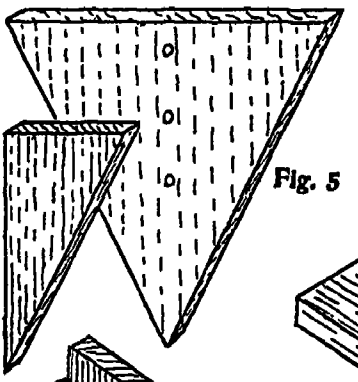


Fig. 5

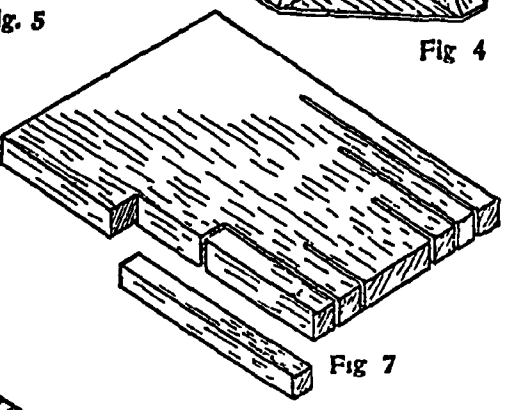


Fig 7

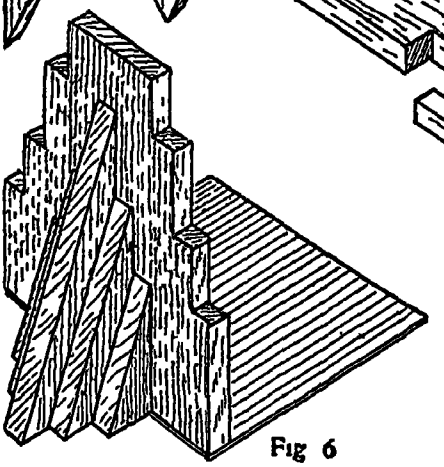


Fig 6

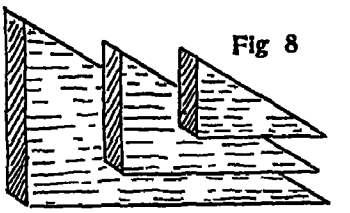


Fig 8

A TEA TRAY

By using plywood, the making of trays is not a difficult job and with a little care an attractive tea tray can be made for a few pence. In the design at Fig. 1 the base is made from $\frac{3}{16}$ in. plywood, with a border of 1 in by $\frac{3}{4}$ in. clean yellow deal or whitewood. The corners are made with the mitre joint and covered with pewter.

Begin by making quite sure that the plywood for the bottom of the tray has square corners and parallel sides. The sides and ends are measured and suitable lengths of 1 in. by $\frac{3}{4}$ in. or $\frac{5}{8}$ in. are cut off. The ends are cut off to an angle of 45 degrees and are fitted on the base. The edges are screwed on from underneath and then the corner plates prepared as at Fig. 2. The pewter pieces should be from $3\frac{1}{2}$ in. to 4 in. long and wide enough to cover the outside, top and inside as indicated. The material can be obtained in several thicknesses, anything from Nos. 20 to 24 S.W.G. will do, although it can be thicker. The four corner pieces should be cut to the shape shown, and to avoid mistakes cut out a shape in stiff paper and fit it in position. The shapes should be fastened on with screws and nails after finishing the wood.

An effective method with either of the above methods of finishing is to stencil a pattern at each corner, using a stencil plate as shown at Fig. 3.

A pleasing method of treating the corners of the tray edges is shown at Fig. 4. The cuts are easily made with a sharp knife, and if the spaces are accurately marked out and carefully cut the result is very effective. It is preferable to use hardwood if the decorative cuts at Fig. 4 are to be used.

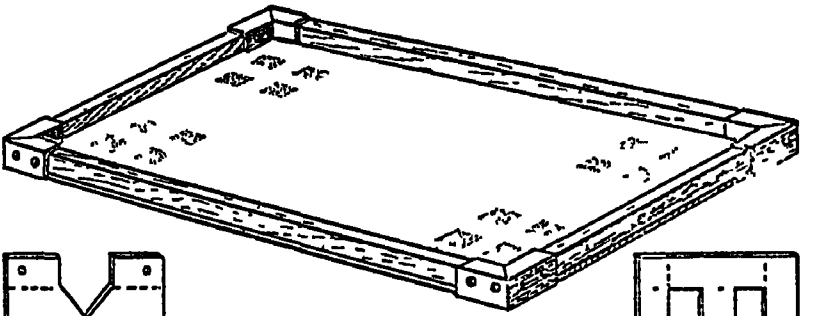


Fig 1

Fig 2

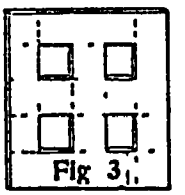


Fig 3

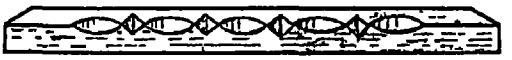


Fig. 4



Fig 5

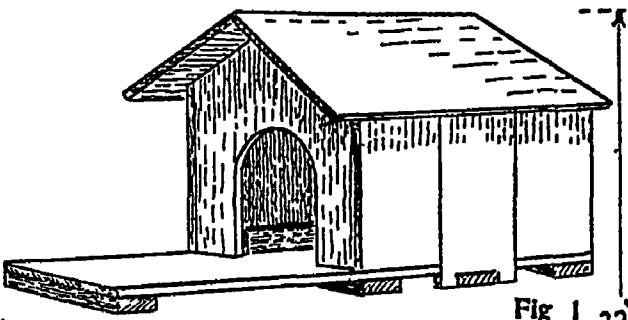


Fig 1

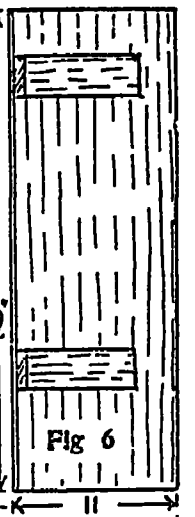


Fig 6



Fig 7

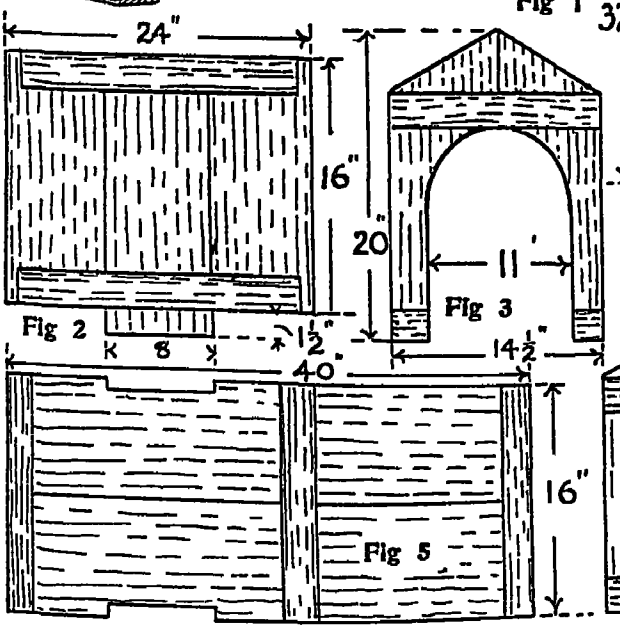


Fig 2

Fig 3

Fig 5

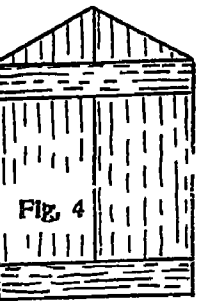


Fig. 4

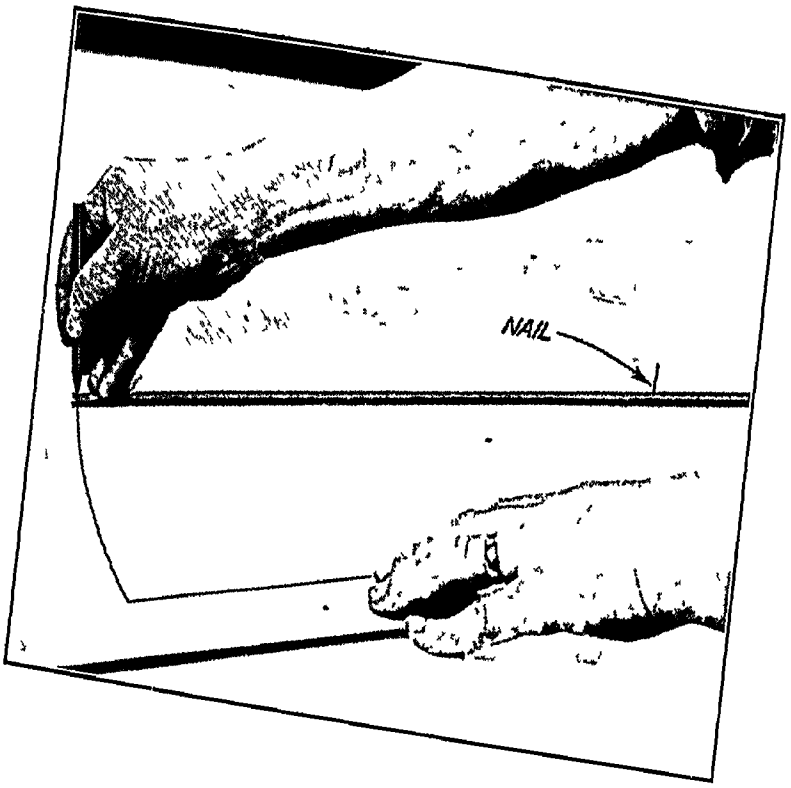
A DOG KENNEL

A dog kennel is a simple job and the design given at Fig. 1, on page 53, although it has definite dimensions, can be altered to suit a larger dog. It has a distinct advantage over the ordinary dog kennel, in so much that the upper portion can be taken off, leaving a perfectly even floor. This allows of the thorough cleansing of the interior.

There are eight distinct parts used in the construction, the floor, the two sides with a connecting piece, the front, back and two portions of the roof. Ordinary yellow deal tongued and grooved board about $\frac{3}{4}$ in. thick should be used. The boarding may be that known as match boarding, but short lengths of tongued and grooved floor boards will be found quite satisfactory.

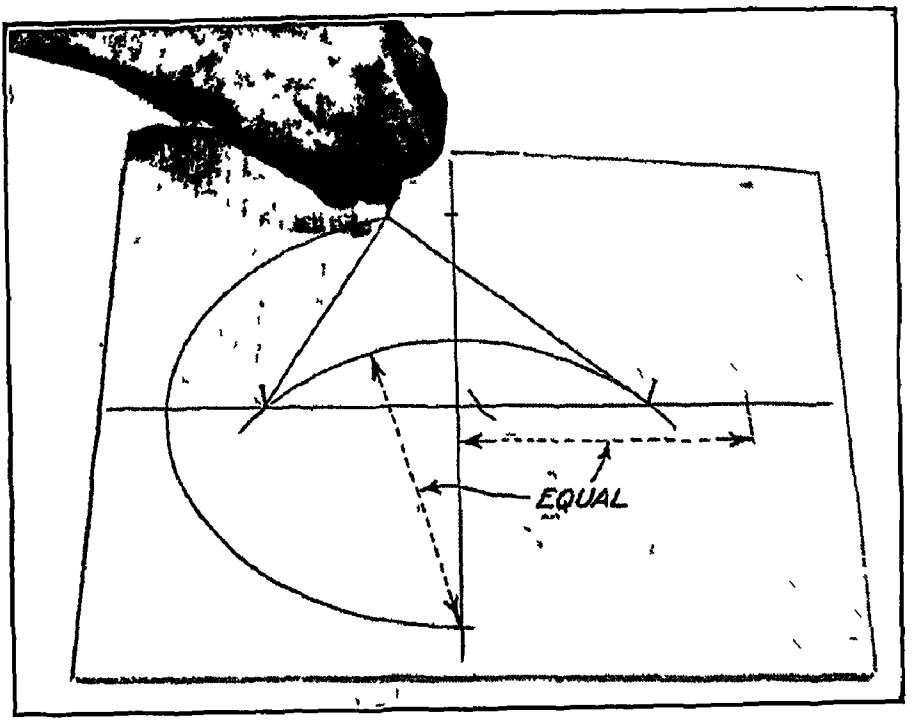
Begin by making the two side pieces as at Fig. 2. The centre board should be cut to a length of $17\frac{1}{2}$ in. and the outer pieces to 16 in., leaving a trifle on the length so that the ends can be planed smooth. If the material is 9 in. wide, the outside boards should be cut down equally so as to give a total width of 24 in. when the three pieces are drawn up close. The two cross pieces should be 2 in. by 1 in., and are $20\frac{1}{2}$ in. long; this provides for sufficient at the ends to allow for the end pieces. The middle projecting piece should be trimmed off to about 8 in. wide. The cross pieces can be nailed, but screwing is much stronger.

The front and back pieces are both alike as regards width and height, but the front, as at Fig. 3, is, of course, open. The two boards are 20 in. long and planed down on the outer edges, so that a total width of $14\frac{1}{2}$ in. is given when close together. The



14 DRAWING A LARGE CIRCLE

BY MEANS OF A THIN LATH, A NAIL AS THE CENTRE AND A PENCIL FOR MARKING, LARGE CIRCLES ARE EASILY DRAWN NOTE THE SMALL "V" CUT AT THE END OF THE LATH



15 DRAWING AN ELLIPSE

THE ABOVE METHOD SHOWS HOW TO DRAW AN ELLIPSE OF ANY SIZE WITH STRING OR COTTON NOTE THE METHOD OF OBTAINING THE CORRECT POSITION OF THE PINS

opening is circular at the top and allows of $1\frac{3}{4}$ in. each side with a height of 14 in. or so. The curves in each piece should be cut with a bow saw or pad saw and finished smooth with a spokeshave. The cross piece at the top is $14\frac{1}{2}$ in. by 2 in. by 1 in. and the two pieces at the bottom $1\frac{3}{4}$ in. by 2 in. by 1 in.

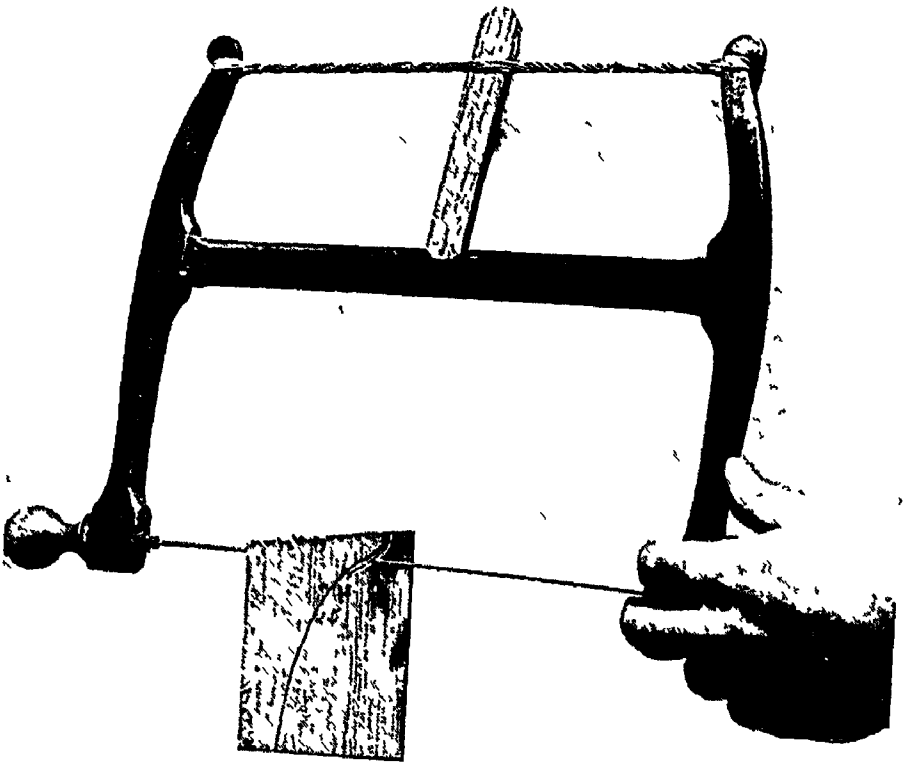
The back, as at Fig. 4, is made from two pieces 20 in. by $7\frac{1}{4}$ in. by $\frac{3}{4}$ in., with two cross pieces, $14\frac{1}{2}$ in. by 2 in. by 1 in. It will be seen that the outside edges are 16 in. high. The floor at Fig. 5 is made up with two 40 in. lengths planed to a total width of 16 in. Three cross pieces are required, each 16 in. by 2 in. by 1 in.

The side pieces are sawn and chiselled out and then the cross piece, measuring 16 in. by 2 in. by 1 in., prepared. It will be seen at Fig. 7 that the ends of this cross piece are sawn to a dovetail. The strips placed in position and marked on the middle pieces and the grooves cut to a depth of 1 in. The front and back pieces are now screwed on or nailed to the side pieces, and then the two portions of the roof, as at Fig. 6, can be prepared. It is an advantage to use two 32 in. lengths of 11 in. board $\frac{3}{4}$ in. thick. The two cross pieces are 2 in. by 1 in. and should be marked off and cut to the length of the slope at the ends. The pieces fit inside so as to leave a projection of 2 in. at the back.

The boards are bevelled on the inside or meeting edges and are then screwed in position. The top may be covered with roofing felt if desired. The connecting bar under the floor is screwed in place after painting and after the inside has been coated with lime wash.

A USEFUL STOOL FOR THE FIRESIDE

The stool shown partly finished at Fig. 1 is not at all difficult to make and when finished will be welcomed at home. It is made from wood planed to $\frac{5}{8}$ in. thick, the best wood to use is oak, but as it may be a little too difficult to work, yellow deal can be used instead. The ends shown at Fig. 2 are finished to $10\frac{1}{4}$ in. by 10 in. and the top at Fig. 3 is 15 in. by 10 in. The stopped groove on the end pieces is marked off 2 in. up, $\frac{5}{8}$ in. wide and $8\frac{1}{2}$ in. long. The top corners are notched out $\frac{1}{4}$ in. down and $\frac{3}{4}$ in. along. The curve is $1\frac{1}{2}$ in. high and drawn to within $1\frac{1}{2}$ in. of the sides. The stopped grooves on the top are 1 in. from the ends, $8\frac{1}{2}$ in. long and $\frac{5}{8}$ in. wide. The grooves should be cut to $\frac{1}{4}$ in. deep before the pieces are sawn apart, but great care should be taken that they are exactly the same width as the thickness of the wood, remembering that a little of the surface of the wood will be removed when cleaning up with the smoothing plane. The curves should be cut with a bowsaw and finished with a spokeshave. The bottom of the stool is shown at Fig. 4, it is finished at $12\frac{1}{4}$ in. by $8\frac{1}{2}$ in. and will fit in the grooves in the ends. One of the sides is hinged and is shown at Fig. 5, the other is similar in size but is a fixture. Each of the two pieces is planed to 9 in. wide and finished $11\frac{3}{4}$ in. long, but it will be as well to leave the actual length until the ends, top and bottom have been glued together. The piece of wood $\frac{3}{4}$ in. square in section at A is $7\frac{1}{8}$ in. long and one piece is glued and bradded to each end to provide a support for the fixed side. The two pieces



16 USING THE BOWSAW

FIX THE WOOD IN THE VICE FIRMLY, TIGHTEN UP THE BLADE BY TWISTING THE CORD, HOLD WITH BOTH HANDS AS SHOWN AND KEEP THE BLADE HORIZONTAL



17 HOLDING THE PADSAW

A PAD OR KEYHOLE SAW IS USEFUL FOR CUTTING CURVES HOLD THE SAW AND THE WOOD AS FIRMLY AS POSSIBLE

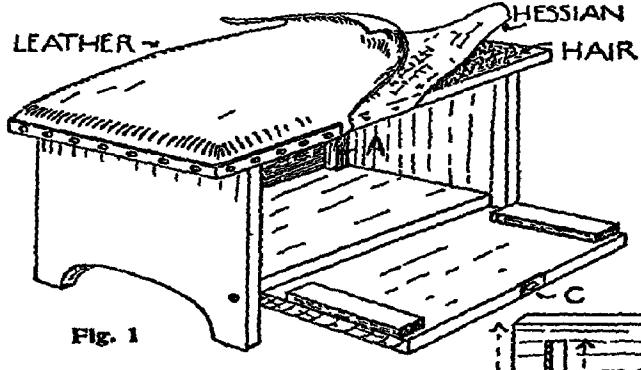


Fig. 1

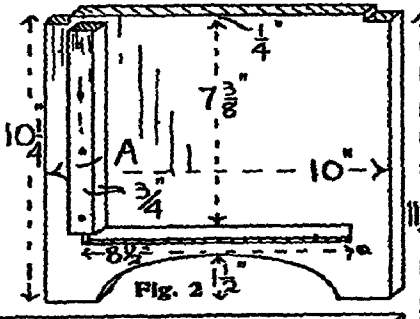


Fig. 2

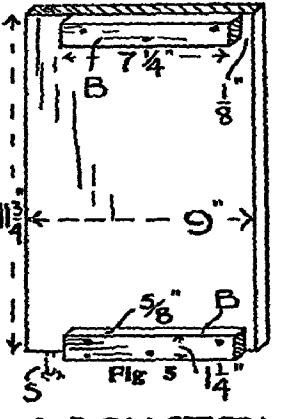


Fig 5

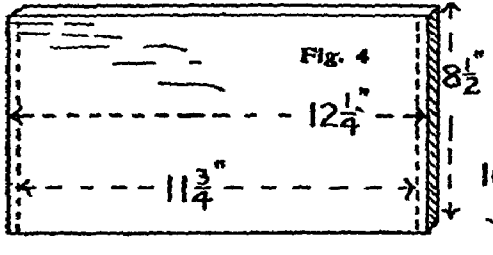


Fig. 4

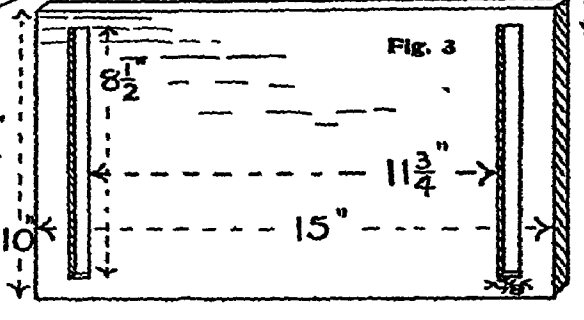


Fig. 3

A BOX STOOL, FOR SLIPPERS, WITH LEATHER TOP.

DC.

at B need not be fitted on, but they will prevent the hinged piece from warping; these pieces, $7\frac{1}{4}$ in. by $1\frac{1}{4}$ in. by $\frac{5}{8}$ in., are glued and screwed on $\frac{1}{8}$ in. from the top. The fixed side should now be cleaned up and glued in after being carefully fitted and then the hinged side secured with $1\frac{1}{2}$ in. screws as at S, the holes are bored in the ends $\frac{5}{16}$ in. below the bottom and $\frac{7}{16}$ in. from the edge. The best method of fastening the hinged side is to use a ball catch, this can be bought very cheaply in a small size. The ball plate should be let in the top and the striking plate on the door as at C. If the wood is oak, it should be polished with beeswax and turpentine; if deal, it can be stained and polished or painted. The top is now padded with curled horsehair, which can be bought at any upholsterers, a layer of about 3 in. high will be sufficient. The material should be covered with hessian, a kind of canvas used by upholsterers, and pulled tightly over the stuffing and tacked to the edges of the wood. A long knitting needle is useful in distributing the hair so as to form an even pad. The leather, which may be rexine or pegamoid, can be obtained at the same shop as the stuffing, should not cost very much as scrap pieces left over from a chair will be obtainable. The edging is a kind of gimp, this also with suitable leather covered nails can be obtained from the upholsterer.

Care should be taken in fitting the leather top to avoid creases, the corners especially must be carefully done; it is impossible to avoid a crease or two here, but if the material is pulled down tightly, the work can be left quite neat.

POLISH AND POLISHING

There are several kinds of polish, each requiring its own method of application. To enumerate them all would be impossible within the limits of this book, so that only those in common use will be described. French polish can be purchased ready for use, but it may be made by dissolving 3 ozs. of shellac in half pint of methylated spirit. Oil polish is merely raw or boiled linseed oil used without further preparation. Wax polish is composed of beeswax dissolved in turps or some similar medium Convenient preparations ready for use in the form of prepared wax and floor or furniture polish are obtainable.

In all kinds of polishing, the first and often the most important operation is the preparation of the surface. The wood should be perfectly dry, the surface quite smooth and free from finger marks and any holes filled up with prepared stopping. A good stopping can be made with French chalk or finely powdered whiting mixed with gum. The grain of porous wood should be filled with a mixture of plaster of Paris and methylated spirit, and when dry, cleaned off with fine glasspaper or pumice powder applied with a thick felt pad.

French polishing is usually considered as beyond the capabilities of the amateur, but with ordinary care, small surfaces at least can be done without difficulty. The first thing to do is to provide a rubber; this is made from washed linen rag of fine texture covering a pad formed from white sheet wadding. Remove the skin from the wadding and work it into a cone shape about 4 in. long and 3 in. diameter at the large end; place it in the centre

of the rag, which should be about 15 in. square, first soaking it with polish, then fold over on the small end, place the corners over in turn and twist the remainder to form a convenient rubber for holding in the fingers. The rubber is now rubbed over the surface in a circular motion so that the whole of the surface is covered; never allow the rubber to stand still, keep it continually on the move and make the polish go as far as possible.

A film of shellac will gradually form on the surface; this must be added to, but it is advisable to do the work in stages, allowing each layer of polish to harden for an hour or two before being touched again. At least half a dozen coats should be applied. If the rubber shows a tendency to stick, a touch of linseed oil will ease it, but this should be done very sparingly. When the surface bears a dull gloss, and the smoothness satisfactory, the final operation of spirting off should be done.

Spirting off consists of rubbing over the work with a pad made of wadding, saturated in methylated spirit, squeezed nearly dry and then wrapped in a clean linen rag, doubled over to give two thicknesses of material under the pad. The rubber is used lightly at first and then the pressure gradually increased as the spirit works out of the rubber. The action is to harden and burnish the surface, and great care should be taken to use as little of the spirit as is consistent with the object in view. Many beginners spoil the work in the final stages by either allowing the rubber to stick on the surface or by using too much spirit.

Oil polishing is an admirable method for the

amateur, its main advantages over French polishing are its simplicity and the fact that it does not show marks. To obtain a lasting effect, polishing should be spread over a few weeks, each application of the oil being rubbed dry and left for a few days before the next is applied. A soft linen rag should be used as a rubber; it should be dipped in raw or boiled linseed oil and applied to the surface so as to completely cover it. The rubber must be used continually until the surface is quite hard and dry; it is hardly possible to polish the surface too much.

Wax polishing imparts an egg shell finish or matt surface and when used on hardwoods such as walnut or mahogany, gives the work a velvety appearance. The surface is not so hard or so durable as it would be if French or oil polished, but on the other hand it can be done very rapidly and is easily renovated. For white woods it is better to use white beeswax, but for ordinary work, the ordinary yellow variety will be good enough. The wax should be shredded as finely as possible, placed in an earthenware pot and covered with turpentine. If allowed to stand for several days and stirred from time to time, the wax will dissolve, but a quick method is to place the pot in a saucepan of hot water and allow it to simmer over a small gas ring. For soft woods the wax should be used as a thick paste, but for all hardwoods, it need not be more than of a creamy consistency. A piece of well washed flannel forms the best rubber, a good plan is to use strips of the material about 1 in. wide, wrap them round and round to form a pad. The wax should be applied in thin coats and thoroughly well rubbed into the wood, the finishing should be done with a clean soft cloth.

A HANGING FERN BASKET

The fern basket shown at Fig. 1 is very easily made and forms a most effective method of growing many kinds of ferns and flowers. The material shown can be of any wood square in section, from ½ in. side to 1 in. according to the size of the basket required. But boys who live in the country will have an opportunity of using short lengths of round wood, cut from the branches of trees which can be picked up in the neighbourhood of a wood, with the exception of the base, which should be of planed wood about 10 in. square.

If the basket is to be placed in such a position that the bottom surface is shown, short lengths of bark covered branches can be split and attached to form a pattern as at Fig. 2. If this is done, the four side wires, about ⅛ in. diameter, should be fitted in position beforehand as at Fig. 3.

It will be seen that the length of wire, which should be galvanised, is passed through the bottom and the end is bent over twice at right angles, the point formed with a file and then driven into the wood. The wire should be long enough to be fastened to a ring at the top, but if desired the four pieces can be a little longer than the sides of the basket and either small chain or picture wire used to hold it up.

The round lengths of wood used for the sides should be the same length as the sides of the base, and each one should be drilled with a hole so that it can pass through the wire as at Fig. 4.

A coat of size and two coats of varnish should be applied to the finished work.

FIG. 1.

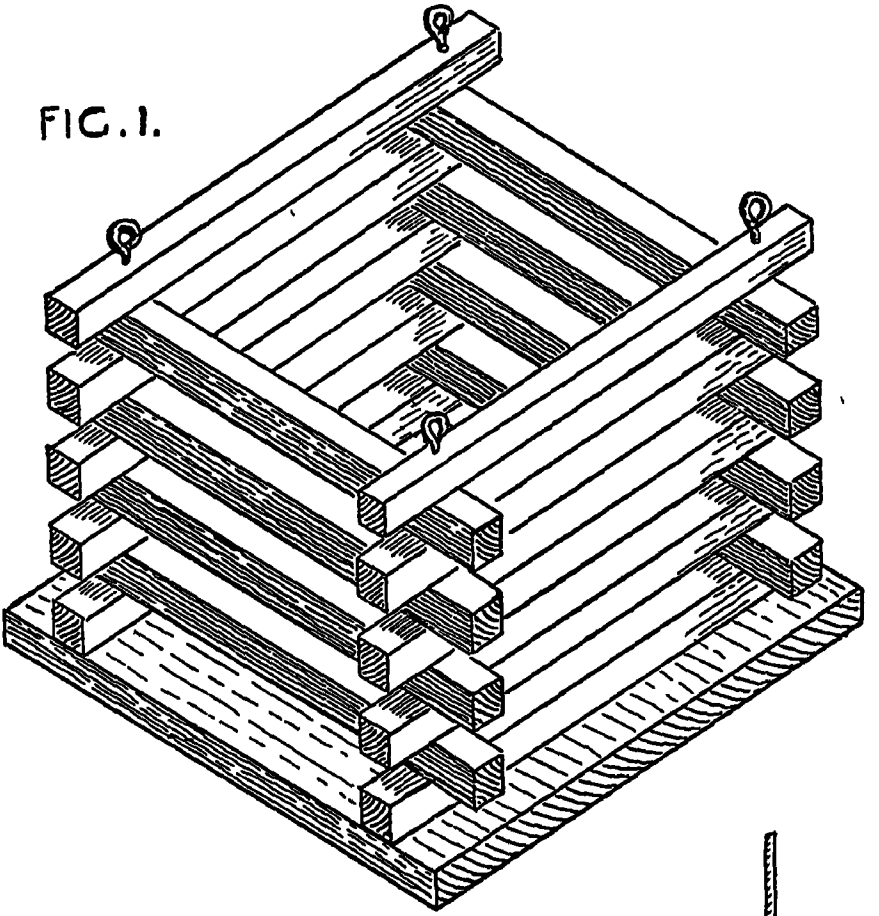


FIG 3

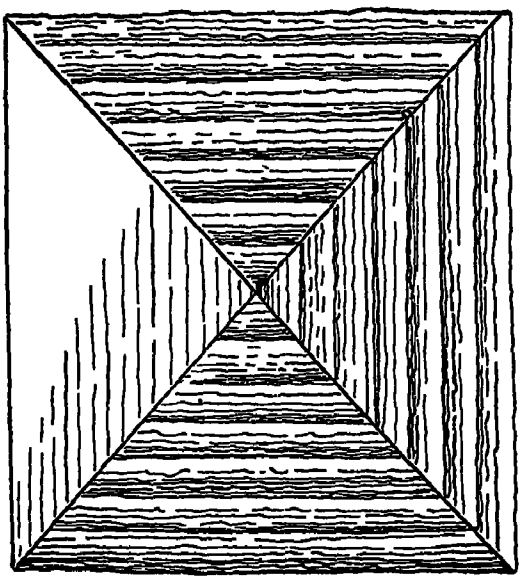
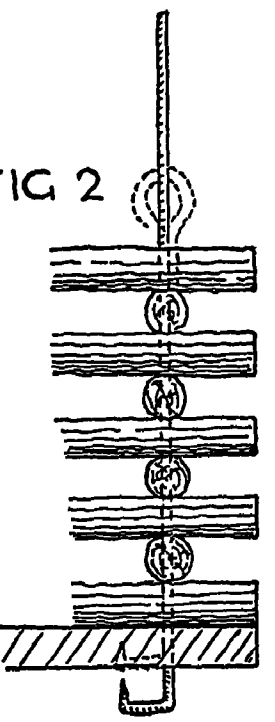


FIG 2



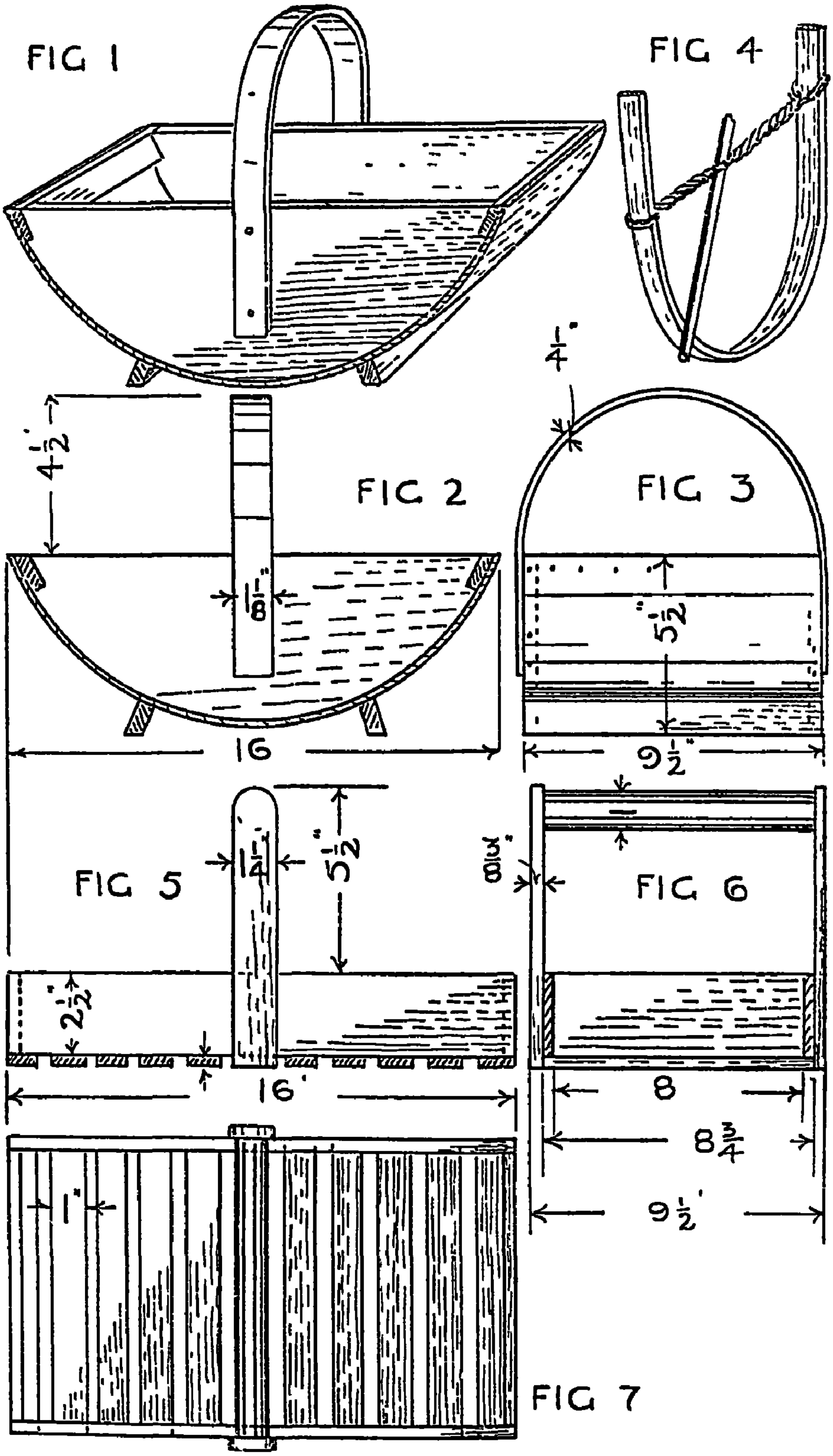
GARDEN BASKETS

One of the most effective is the Trug, a simple form of this particular basket at Fig. 1 can be quite easily made from an old cheese box, or the material can be provided by using $\frac{3}{4}$ in. wood for the sides and thin three-ply for the curved bottom. Dimensions are given at Figs. 2 and 3 for a basket of a convenient size for general garden use. As the plywood is liable to exercise an outward pull, it is advisable to nail the top edges to a strip of wood let in and nailed to the shaped sides.

The handle may be made similarly to that shown at Fig. 5, but if a thin piece of ash can be obtained, the curved handle suggested looks well. The ash should be steamed for some time for the greater part of its length and then it is bent to the required shape in the manner shown at Fig. 4. At first the string need not be twisted, and the wood steamed again before it is pulled to the shape. Nail or screw it on and then screw on the feet pieces.

The flat tray or basket at Figs. 5, 6 and 7 is a simple piece of construction. The sides, cut from $2\frac{1}{2}$ in. by $\frac{3}{8}$ in. wood, should be cut to the lengths required, 16 in. by 8 in. makes a convenient size. Nail them together and nail on strips of $\frac{3}{8}$ in. wood cut to $8\frac{3}{4}$ in. long and planed to 1 in. wide.

The handle for this basket is formed by two side pieces each 8 in. long, $1\frac{1}{4}$ in. wide and $\frac{3}{8}$ in. thick, and a round top, about 1 in. diameter. A short length of 1 in. birch dowel can be used, but an $8\frac{3}{4}$ in. length cut from an old broom handle is quite suitable. The top of the side pieces should be trimmed to a curve with a radius of $\frac{5}{8}$ in. and finished neatly with a sharp chisel.


FIG 1
FIG 2
FIG 3
FIG 4
FIG 5
FIG 6
FIG 7
4½'
1⅛"
16
¼"
5½"
9½"
1¼
5½"
2½"
16'
8
8¾
9½'
1"

GARDEN SEED FRAME

The seed frame shown at Fig. 1 is not difficult to make; a useful size being a length of 24 in., a width of 16 in., and a total height, excluding the handle, of 9 in., sloping to 6 in. at the sides.

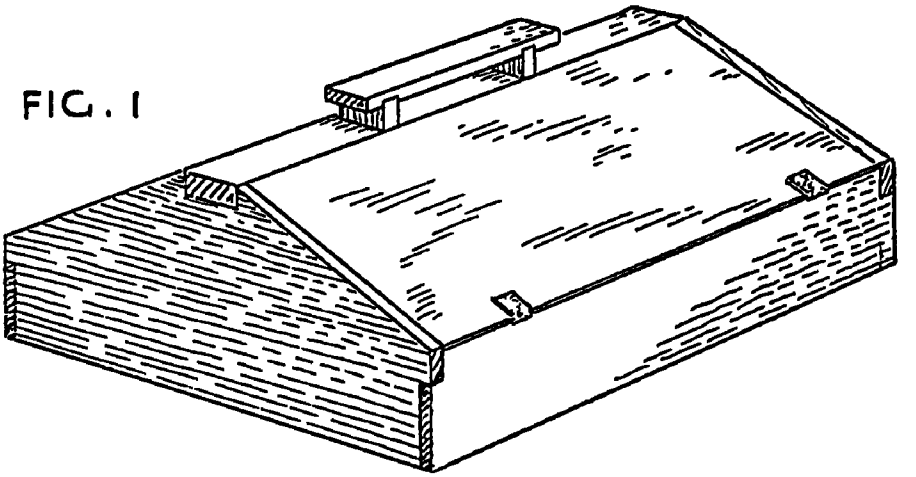
The end pieces should be of stout material, from ¾ in. to 1 in. thick. Plane to the shape, leaving a flat portion about 2 in. wide on top. Provide four strips, 1 in. by ½ in. for the fillets at A, which are to form the rebates to carry the glass fronts. These pieces should be nailed on as shown at Fig. 2, leaving space for the thickness of the glass. Provide two side lengths, approximately 5½ in. wide and ½ in. thick, and notch them into the end pieces as shown at Figs. 1 and 2. Before nailing them on, the top edges should be planed to the same slope and to the same level as the top of the pieces A. The top bar, at Fig. 3, can be let in as shown or dovetailed, the latter being the stronger job. Brad to the inside of this top bar on each side small fillets on which the glass will rest.

Prepare a handle from 2 in. by 1 in. wood as shown at Fig. 4, let it into the top bar and secure the uprights with wedges when glueing up. The glass should be cut to fit on the rebates on each side and should rest on the top and side fillets as well as on the side pieces.

Four pieces of thin zinc about 2 in. long and from 1 in. to ¾ in. wide should be cut out and screwed on the inside of the side pieces as shown at B. The pieces are left projecting until the glass has been fitted in position and are then folded over.

The wood should be painted at least with three coats of good oil paint before the frame is used.

FIG. 1



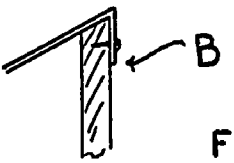


FIG. 3

FIG 2

FIG 4

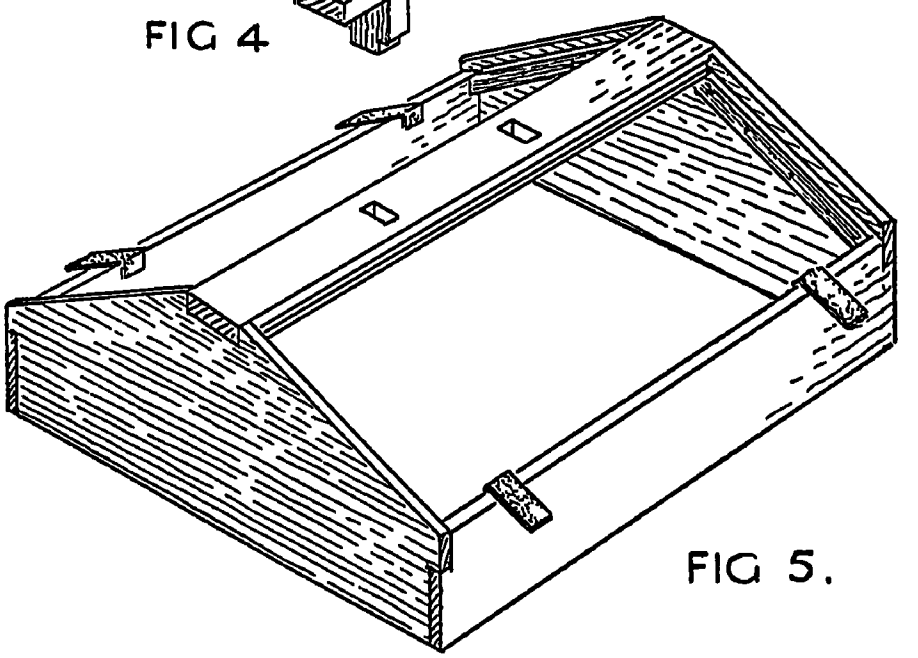


FIG 5.

EASILY MADE FLOWER BOXES

When flower time approaches many boys will be looking for suitable designs for boxes and stands for growing flowers. Window boxes are not difficult to make and, provided that they are made from stout material, not thinner than 1 in., the sides can be nailed together.

The flower box, shown at Fig. 1, is not intended for the outside window sill, but it can be used inside or on a side table, shelf or stand in the garden. It can be used without a zinc lining if the inside is coated quite thickly with pitch.

Suitable measurements are given for one of the end pieces in Fig. 2, the length being arranged to suit the particular case. It will be seen that the sides are fitted in grooves cut in the end pieces, they are then screwed or nailed in place. When complete, melt some pitch in an old pail and apply it thickly with a trowel.

The flower box shown at Fig. 3 provides an opportunity of using up odd lengths of wood. The inside dimensions should be about 10 in. square and about 8 in. deep. The sides may be any thickness from $\frac{1}{2}$ in. to 1 in., according to the size of the box; the best method of joining the sides is to use the tongue and groove joint as shown at Figs. 4 and 5.

The strips of wood attached to the sides serve not only as decoration but they help in keeping the side pieces together. The strips need not be more than $\frac{1}{4}$ in. or $\frac{3}{8}$ in. thick, they can be bradded on. Finish the box with two or three coats of paint on the outside, but the same finish inside, that of pitch, is preferable to paint on the inside.

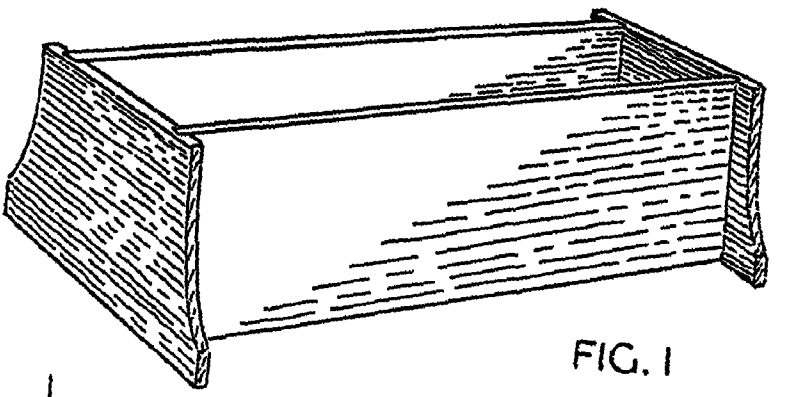


FIG. 1

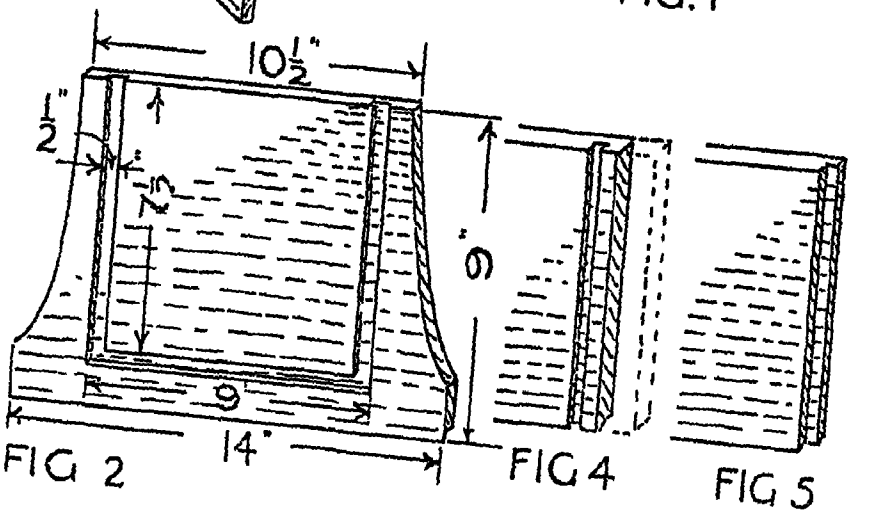


FIG 2 FIG 4 FIG 5

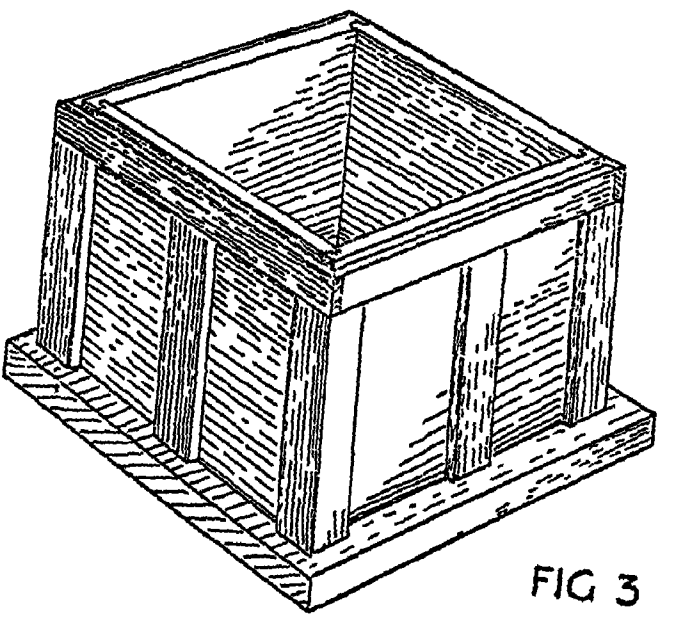


FIG 3

GARDEN LINE REEL

The reel shown at Fig. 1 will be found of great use in the garden and is easily made of some ½ in. wood and some 1 in. round wood or a length of broomstick. The section at Fig. 2 indicates the method of construction, the sizes given should, as far as possible, be used. It will be seen that the round pieces are let into the cross pieces.

The top portion A should be prepared to 8 in. by 1¼ in. by ½ in., the lower piece B should be the same in length and thickness, but planed to 2 in. wide. The outside uprights are cut from the round wood to 6½ in. and are let into ½ in. diameter holes bored ½ in. down into both pieces A and B. The peg fits through the bottom piece B and rests under the top piece. It is cut off about 15 in. long and is pointed as shown on the end in the separate detail at D.

The plate at E and F should be of brass about ⅛ in. thick and not less than 2 in. diameter. It is drilled with five holes, one in the centre and four equally spaced on the outside. Screw it firmly to the top of the peg. A pin, as shown at F, attached to a short length of string, should be provided so that the reel can be held at any position.

A PLANT SUPPORT

The plant support shown at Fig. 4 is a simple job in sawing and can be carried out in any straight grained piece of wood from ½ in. to 1 in. thick. The strips are cut down along gauge lines. They are all equally spaced, as at B, the strip at C being used to keep the bent pieces in position. Brads or panel pins should be used to secure the bar.

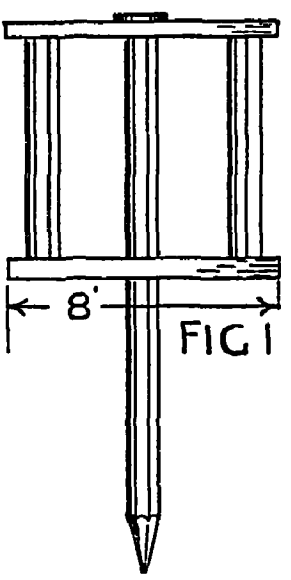
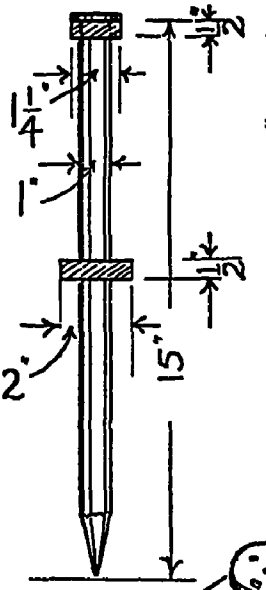


FIG 1



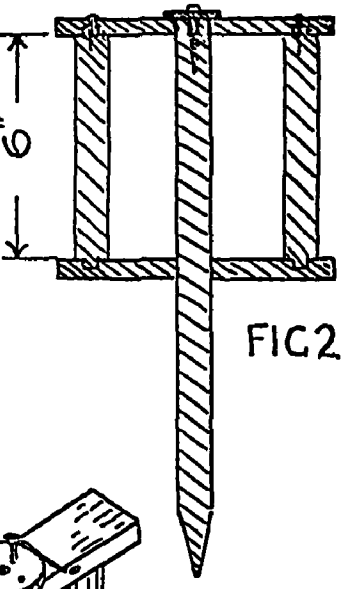
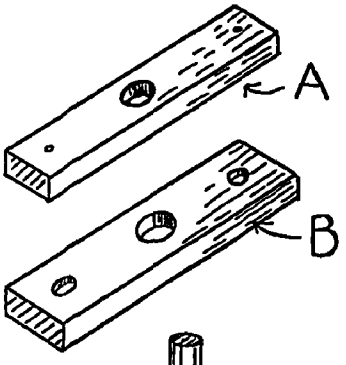


FIG 2



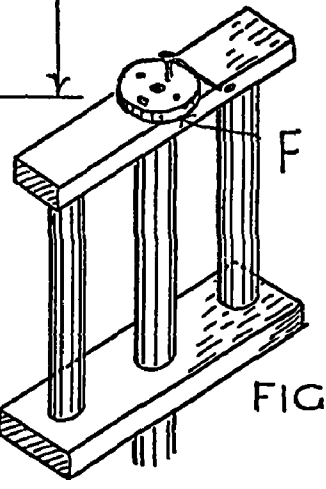
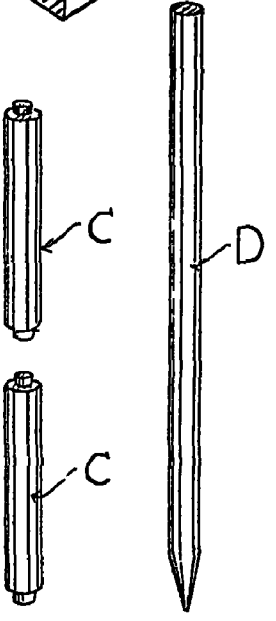




FIG 3



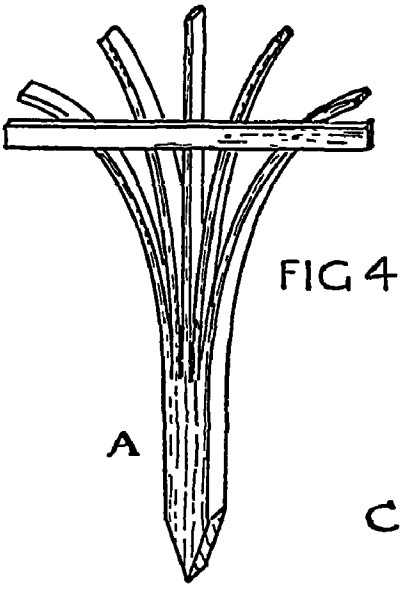


FIG 4



BIRD HOUSES

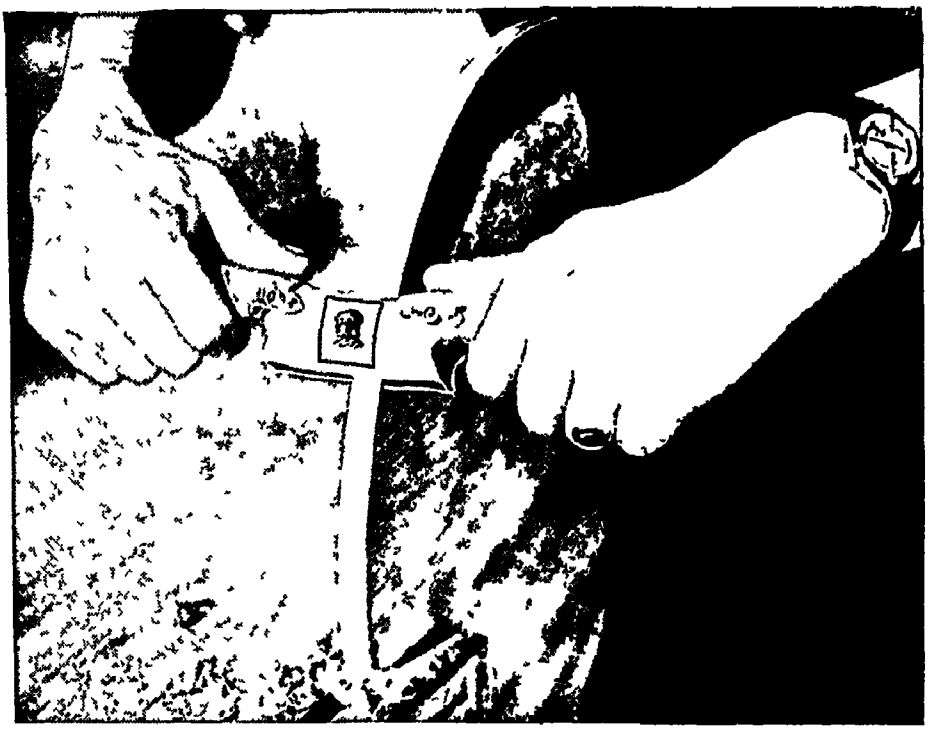
The house at Fig. 1 is shown at Fig. 2 in end elevation and plan. Underneath the plan is a diagram showing the side view. To make the house, use wood at least $\frac{1}{2}$ in. thick. The thickness can be more, even 1 in. thick would not be too much.

Nail the sides together, but before doing so coat the inside surfaces with lime wash and the outside may be painted or coated with creosote afterwards. The sizes given provide for a house of useful size.

Another form of house which may be made of wood from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. thick is shown at Fig. 3. It is made similarly to that at Fig. 1. Figs. 4 and 5 are also similarly made with a different roof.

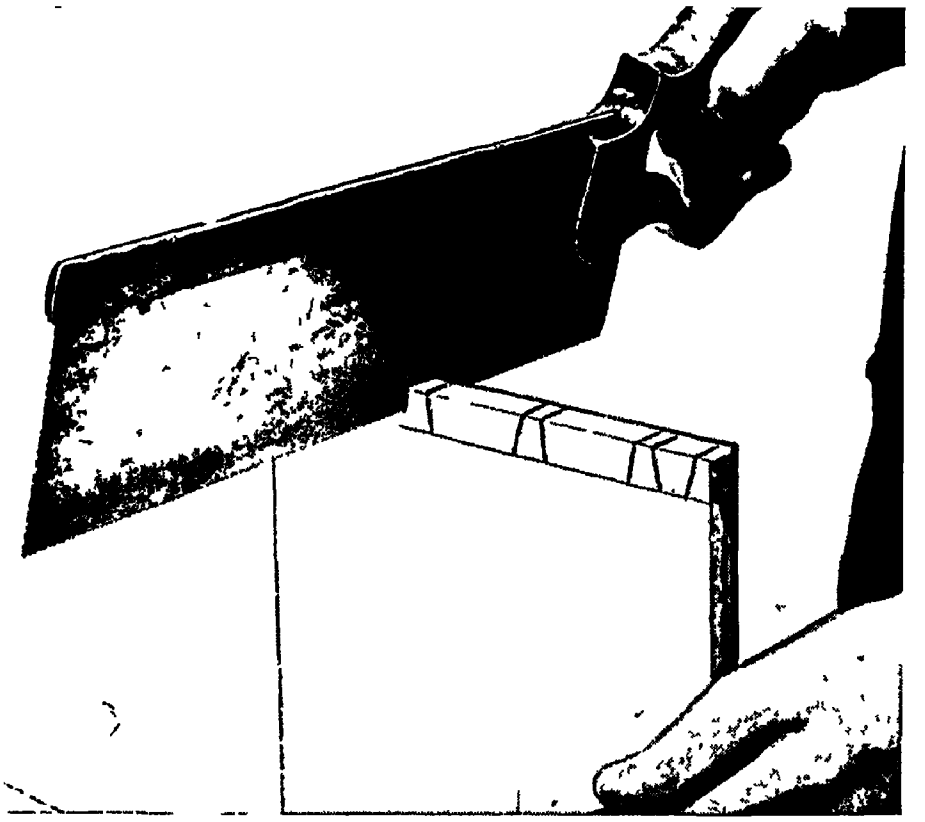
A different kind of house is shown at Fig. 6. In this case it is necessary to obtain a portion of the trunk of a small tree or a piece cut from a large branch. The greater portion of the inside wood should be cut away; with a little patience this can be done with a gouge. The roof can be made as shown at Fig. 6 by cutting the branch to a point as shown at A. Another way is to make a sloping roof by cutting the wood as indicated at B. The bottom of the house can be formed by a plain board, but a thin section of tree trunk cut off as at C makes a more pleasing finish. The roof, as shown at D, may be of board.

A feeding table is shown at Fig. 7. This, made to the sizes shown in the front and side views, can be placed on an upright or secured to a suitable branch on a tree. The wood used should not be less than $\frac{1}{2}$ in., but it would be better to use $\frac{3}{4}$ in. wood at the bottom with uprights of 1 in. section. Dowelling can be used for perches.



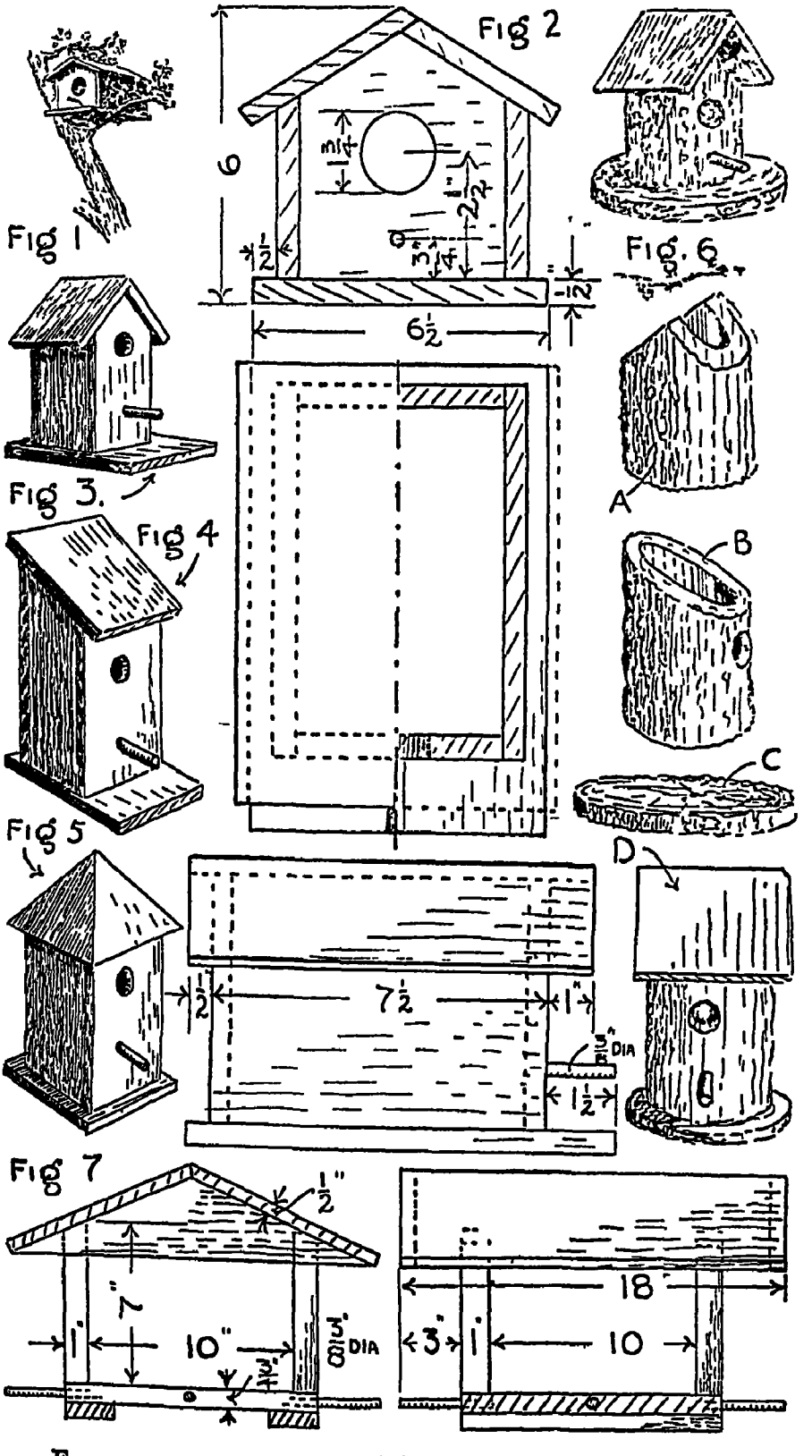
18 USING THE SPOKESHAVE

THE SPOKESHAVE IS HELD WITH BOTH HANDS AS SHOWN ABOVE KEEP THE CUTTING BLADE SHARP AND SO SET THAT IT TAKES OFF A THIN SHAVING AND ALWAYS TAKE THE SHAVINGS OFF IN THE DIRECTION OF THE GRAIN KEEP THE TRY-SQUARE AT HAND SO THAT THE WORK CAN BE TESTED AS IT PROCEEDS



19 SAWING DOVETAILS

ALWAYS SAW ON THE WASTE SIDE OF THE LINE HOLD THE TENON SAW FIRMLY AND WATCH THE DIRECTION OF THE LINES


Fig 1
Fig 2
6
1 3/4
2 1/2
3 1/4
1/2
1/2
6 1/2
Fig. 6
A
B
C
Fig 3.
Fig 4
Fig 5
D
7 1/2
1"
3/8" DIA
1 1/2
Fig 7
1/2"
7"
1'
10"
3/8" DIA
3/4"
18"
3"
1'
10"

TWO EASILY MADE GARDEN SEATS

Commencing with the seat at Fig. 1, the first thing is to obtain suitable material; for the legs A and cross rails B, use some 2 in. square deal.

The seat strips should be at least $1\frac{1}{4}$ in. thick for a seat 6 ft. long. The legs should be 2 ft. 6 in. long and the rails about 14 in. or so, this will allow of five 2 in. wide seat strips with 1 in. between or five $2\frac{1}{2}$ in. wide strips equally spaced.

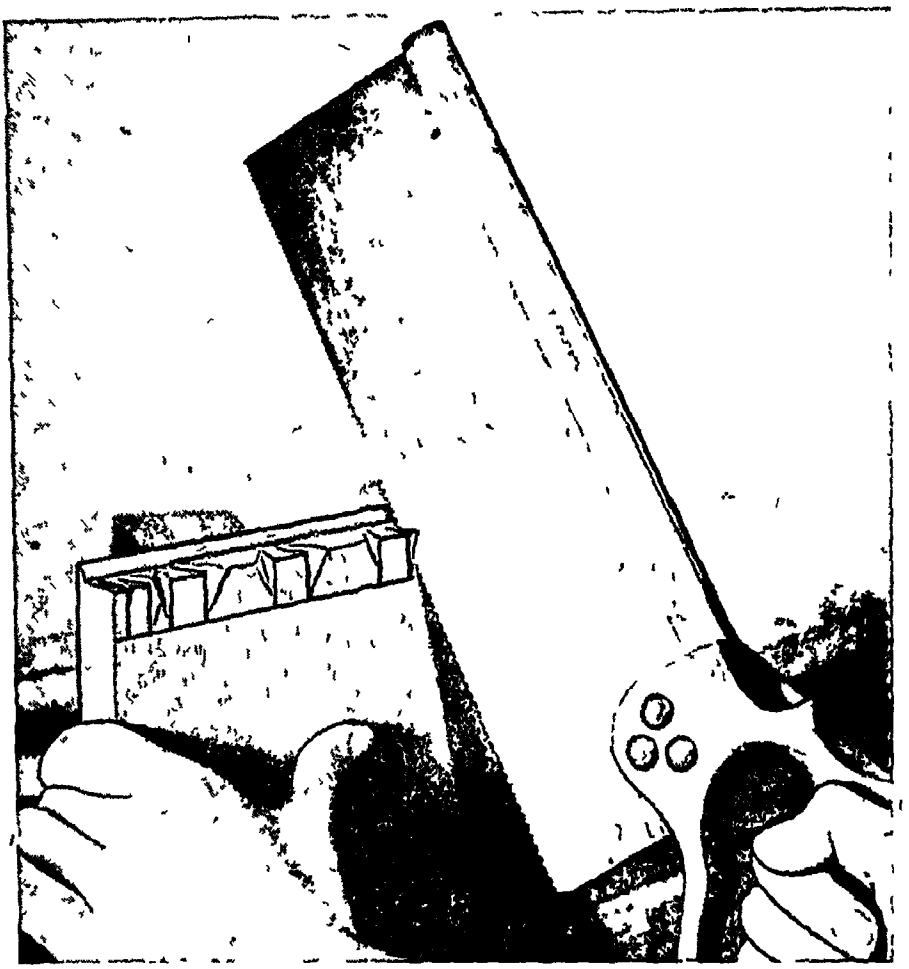
First form the mortise and tenon joints, and then let the legs into the ground, leaving about 3 in. overlap at each end. The top surface of the rails should be kept to the same level and both pieces driven in firmly to the correct height above ground; the portion to enter the ground should be coated with creosote or tar.

The rustic form of seat at Fig. 3 can be constructed with round poles about $1\frac{1}{2}$ in. to 2 in. diameter, with or without the bark.

The length of the poles as shown in the enlarged end view at Fig. 4 should be about 4 ft., this will allow of about 12 in. to be driven in the ground. The supporting piece or strut B should be about 3 ft. 6 in., both of these pieces are pointed at the ends and the strut C should be shaped at the top to fit into a notch cut in the back of the piece B.

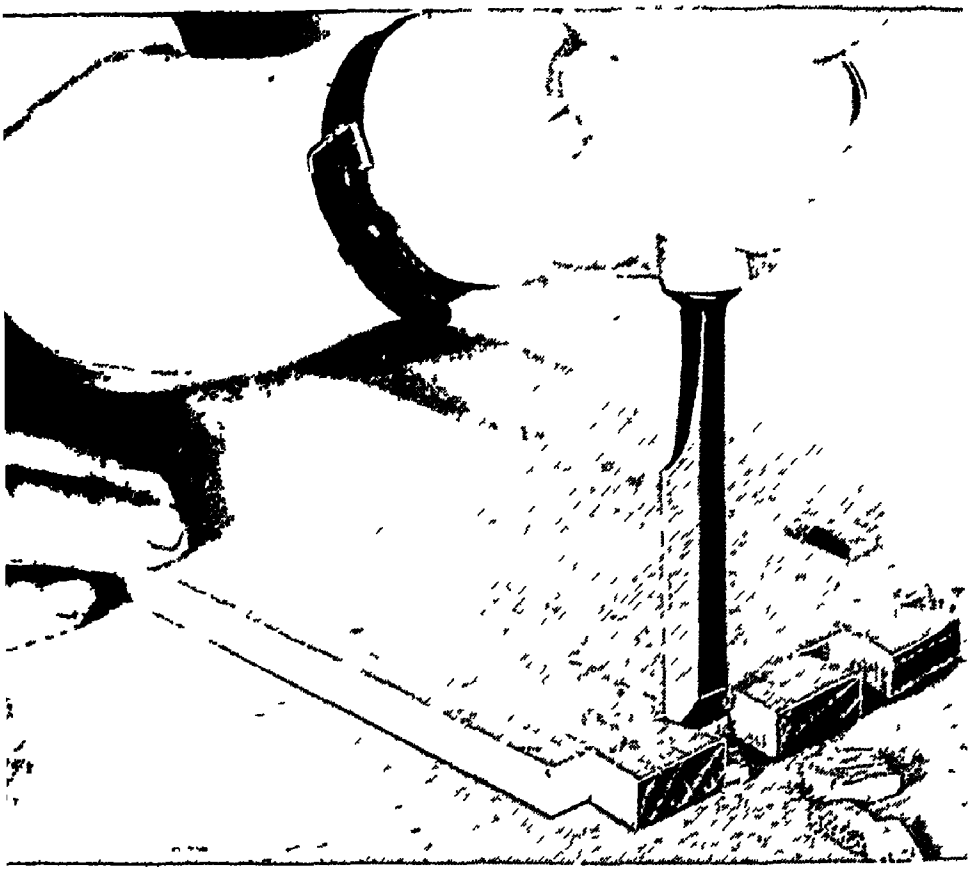
The front leg of the seat, A, should be about 2 ft. 6 in long, the end is sharpened and the seat rail, D, notched in as at Fig. 5. The seat rail can be of 4 in. by 2 in. wood, or it can be formed by sawing down some round wood of larger diameter.

The seat and back strips should be either $1\frac{1}{4}$ in. or $1\frac{1}{2}$ in. thick, depending on the length of the seat, the width should be from 3 in. to 4 in.



20 CUTTING DOVETAILS

THE ABOVE PHOTOGRAPH SHOWS A METHOD OF SAWING OUT A PORTION OF THE WASTE FINISH WITH A SHARP CHISEL.



21 HOLDING THE PARING CHISEL

GRASP THE HANDLE FIRMLY, AND KEEP THE BLADE VERTICAL. NOTE THE POSITION OF THE LEFT HAND BEHIND THE CHISEL

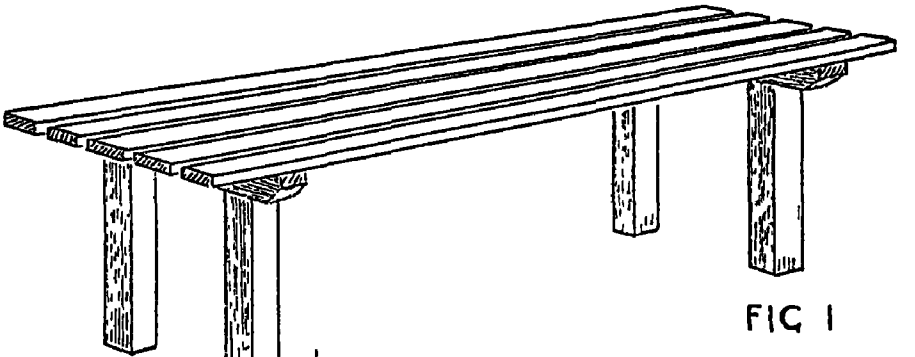


FIG 1

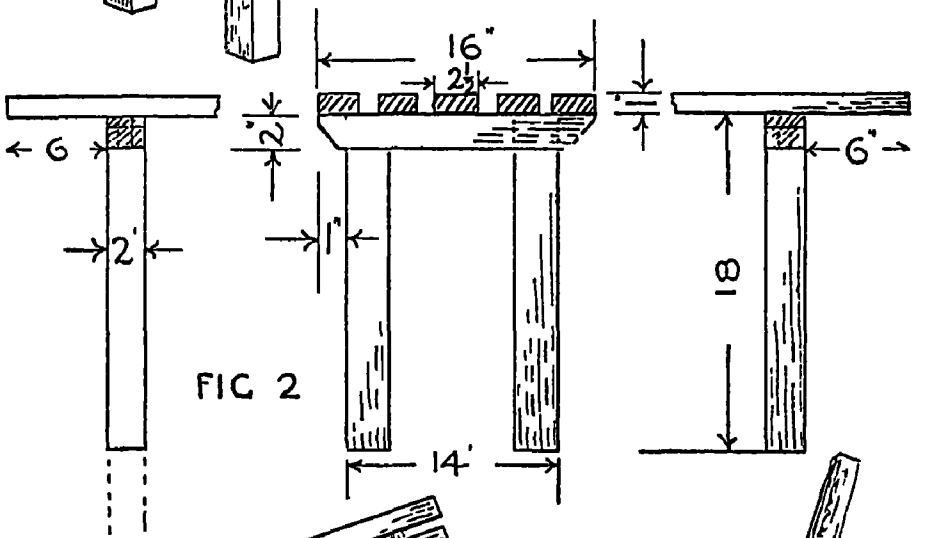


FIG 2

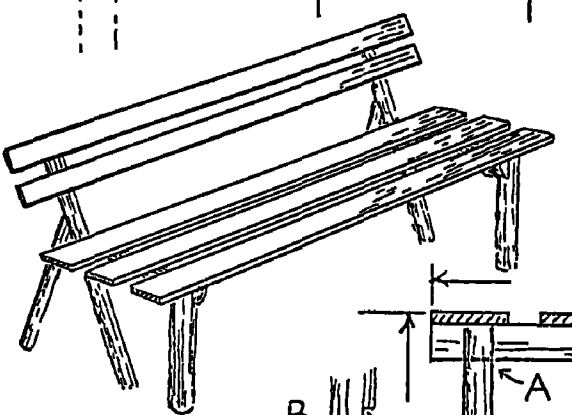


FIG 3

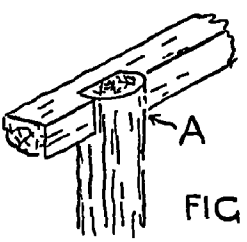
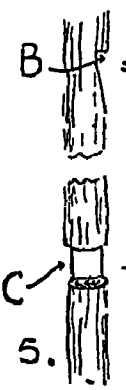


FIG 5.



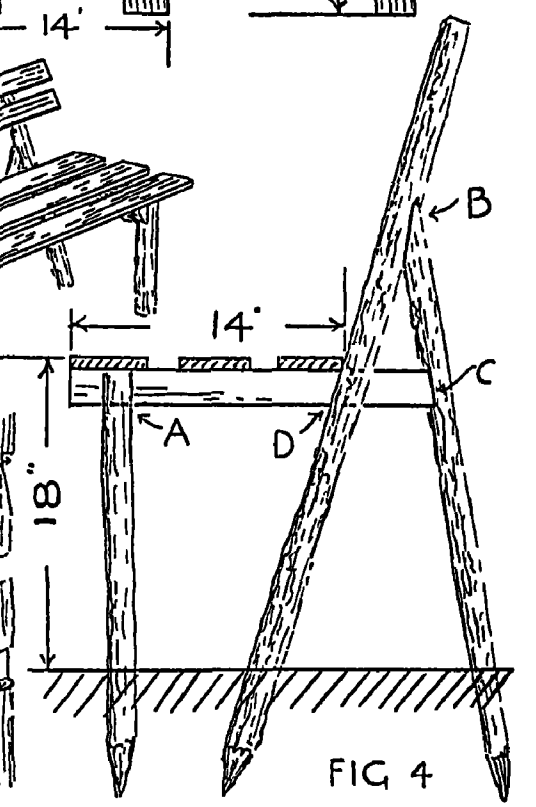
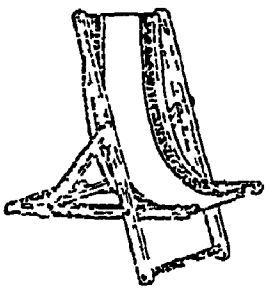
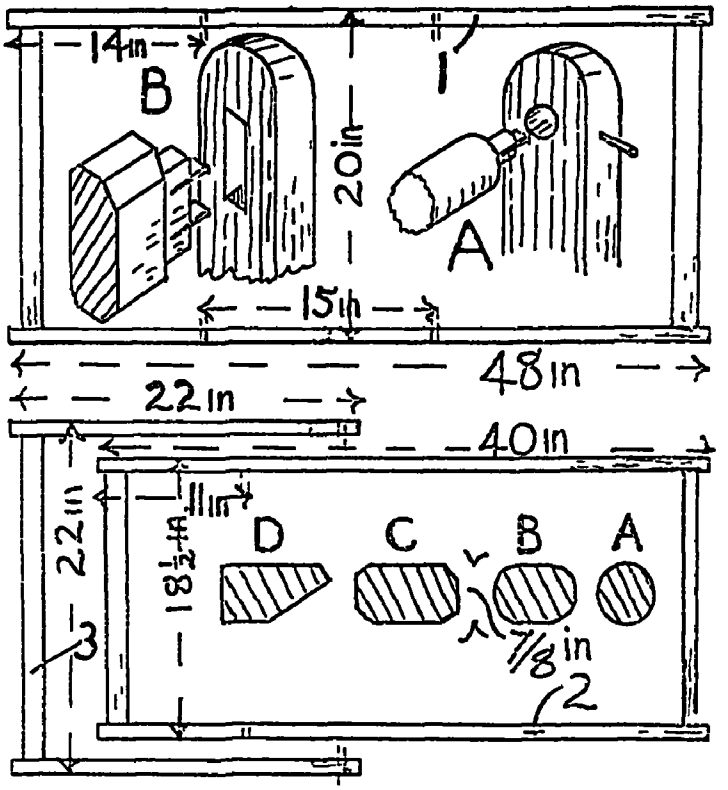


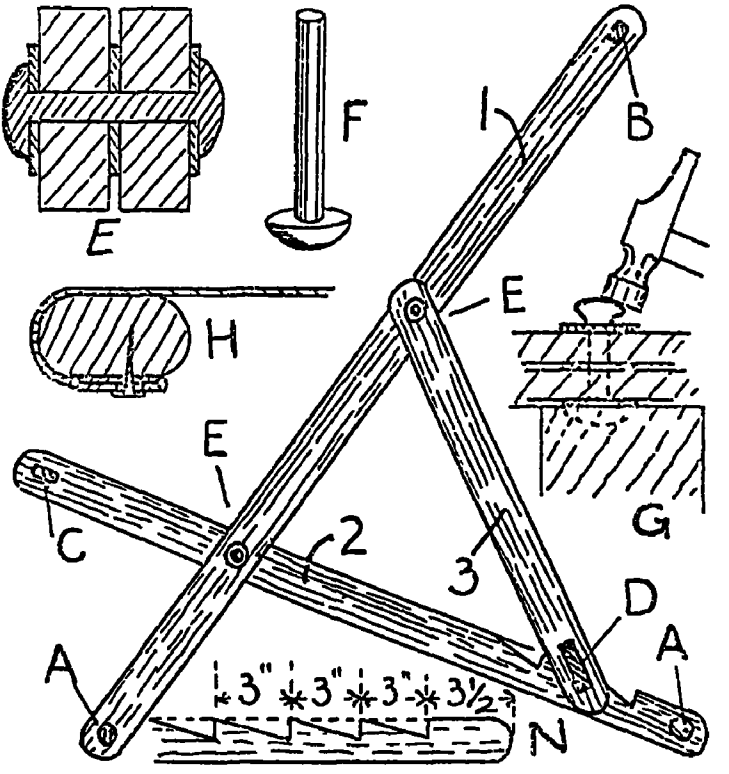
FIG 4

HOW TO MAKE A FOLDING CHAIR

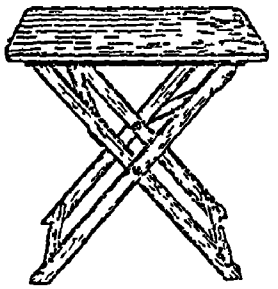


In this chair, known as a folding or deck chair, there are three frames made of hardwood planed to 1¼ in. by ⅞ in. and slightly rounded on the corners. These frames are shown in Fig. 2 and numbered 1, 2 and 3. The rails joining them are shown in section A, B, C and D. Frame 1 is composed of two 48 in. lengths with a round rail A at one end of 1 in. diameter and a rail B, with rounded edges, 1¼ in. by ⅞ in. The method of tenoning these rails in is shown at A and B. Wedges are used as shown to keep the tenons tight. Frame 2 is made with two lengths 40 in. long with a rail A at one end and another of the section at C at the other, this is 2 in. by ⅞ in. with the corners planed off, they are both tenoned in as before and the completed frame should fit inside frame 1, leaving a space of ⅛ in. each side. The lower end of the frame should be notched as at N, either three or four notches being usual. No. 3 frame has two sides 22 in. long with a rail of the section shown at D, it is 22 in. wide and allows of a space of ⅛ in. each side of frame 1. The next step is to bore the holes as shown by the dotted lines and then rivet the lengths together as at E. The rivets should be of iron ⅜ in. diameter with washers ⅛ in. thick. The method of hammering over the straight end of the rivet is shown at G, the round end of the rivet should be supported on a piece of lead or very hard wood. The canvas is tacked to the rails B and C, with the ends doubled under as at H.

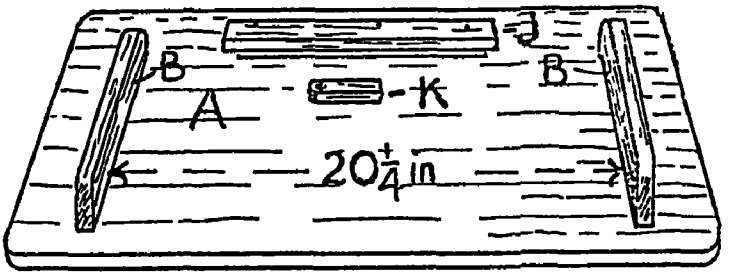

14in
B
1
20in
A
15in
48in
22in
40in
22in
11in
18½in
D
C
B
A
3
7/8 in
2

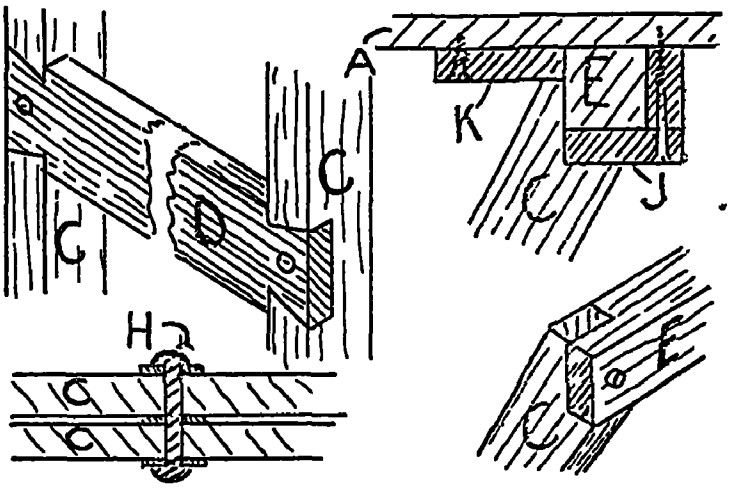

F
E
1
B
E
H
E
C
2
3
G
D
A
A
3"
3"
3"
3½
N

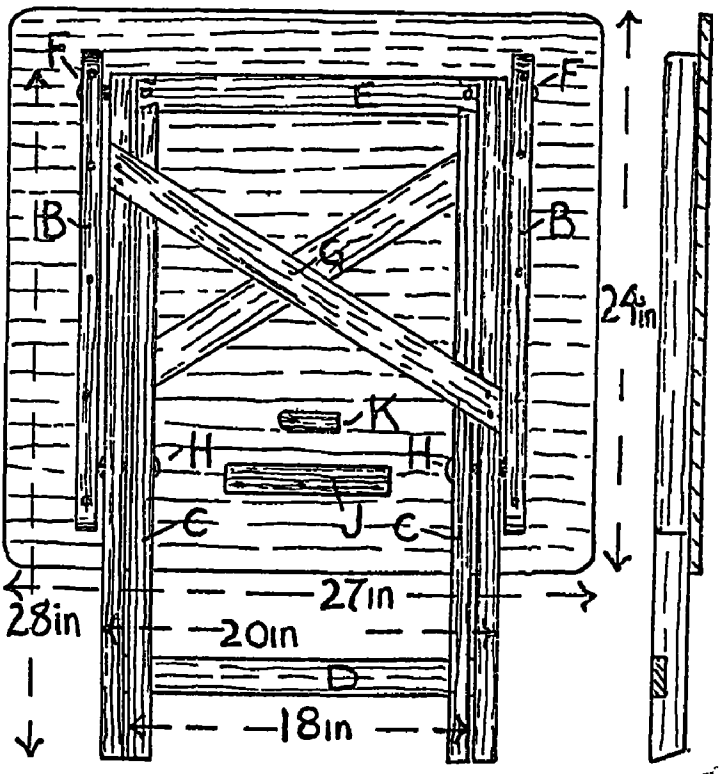
HOW TO MAKE A FOLDING TABLE



This folding table is quite simple in construction and is strong enough for all ordinary purposes. The top can be of ½ in. wood, but plywood will be stronger and not liable to warp. The two rails B are 21 in. by 1¾ in. by ¾ in., the ends are rounded and the strips are screwed to the top to give a distance of 20¼ in. between. The legs C are 33 in. by 1¼ in. by ⅞ in. and made in pairs, one pair is 20 in. wide and the other 18 in. wide. The lower ends are joined with a cross rail D, planed to 1½ in. by ½ in. and dovetailed and screwed at the ends. The width apart of the inner leg at the stop is kept to the required size with a strip of 1 in. square wood E, the method of forming the joint is shown to an enlarged scale. The widest pair of legs is screwed or rivetted to the rails B at F, and to strengthen both pairs of legs, they are provided with strips G, planed to 1½ in. by ¼ in. The two pairs of legs are hinged together with iron rivets half way up as shown in the section at H. The method of fixing the free pair of legs is effected by means of a stop J, into which the square top fits and it is retained in position by button K, which is screwed to the underside of the top. An enlarged detail of this fitting is shown. The stop is composed of two pieces ½ in. thick, one piece is a trifle over 1 in. wide and the other, fitting on it at right angles and parallel to the table top, is 1½ in., both being 9 in. long. The bottom should be 3 in. by 1 in. by ¾ in. The wood should be cleaned up, sized and varnished.


B
A
K
B
20¼ in


A
K
J
C
D
H
E


F
B
G
K
H
J
E
24 in
28in
27in
20in
18in

A GARDEN SWING

A swing should be soundly constructed and made of well seasoned timber. The usual design is shown at Fig. 1 and comprises two uprights of 5 in. by 3 in. timber varying from 6 ft. to 8 ft. in height. The method of forming the base, which is below the surface as at Fig. 1, is illustrated by dotted lines. The upright is tenoned into a base, which should be about 2 ft. 6 in. long at least and of the same material as the uprights. The struts are tenoned to the base and the uprights, and should be about 18 in. long; they can be nailed by cutting the ends to a mitre, but the better way is to form stub tenons on the ends. The top piece should be about 3 ft. 9 in. long and the same width and thickness as the uprights, the top of the uprights being tenoned or housed in as shown. The seat is formed with a board of suitable size with cross battens screwed underneath, holes being bored for the ropes. The best form of hook is illustrated at Fig. 3, this kind is much safer than the ordinary hook. The thimble shown at Fig. 4 is used to prevent wear on the rope and is used as in the diagram at Fig. 5. The whole of the work should be thoroughly treated with wood preservative.

In securing the frame in position, the two holes in the ground should be dug out to the required depth for the feet and then the bottom members carefully levelled, not by raising up the lowest, but by deepening the hole in which the highest side rests. The soil should be returned to the hole a little at a time and thoroughly rammed down, failure to do this part of the work properly may cause the struts to give way and weaken the frame.

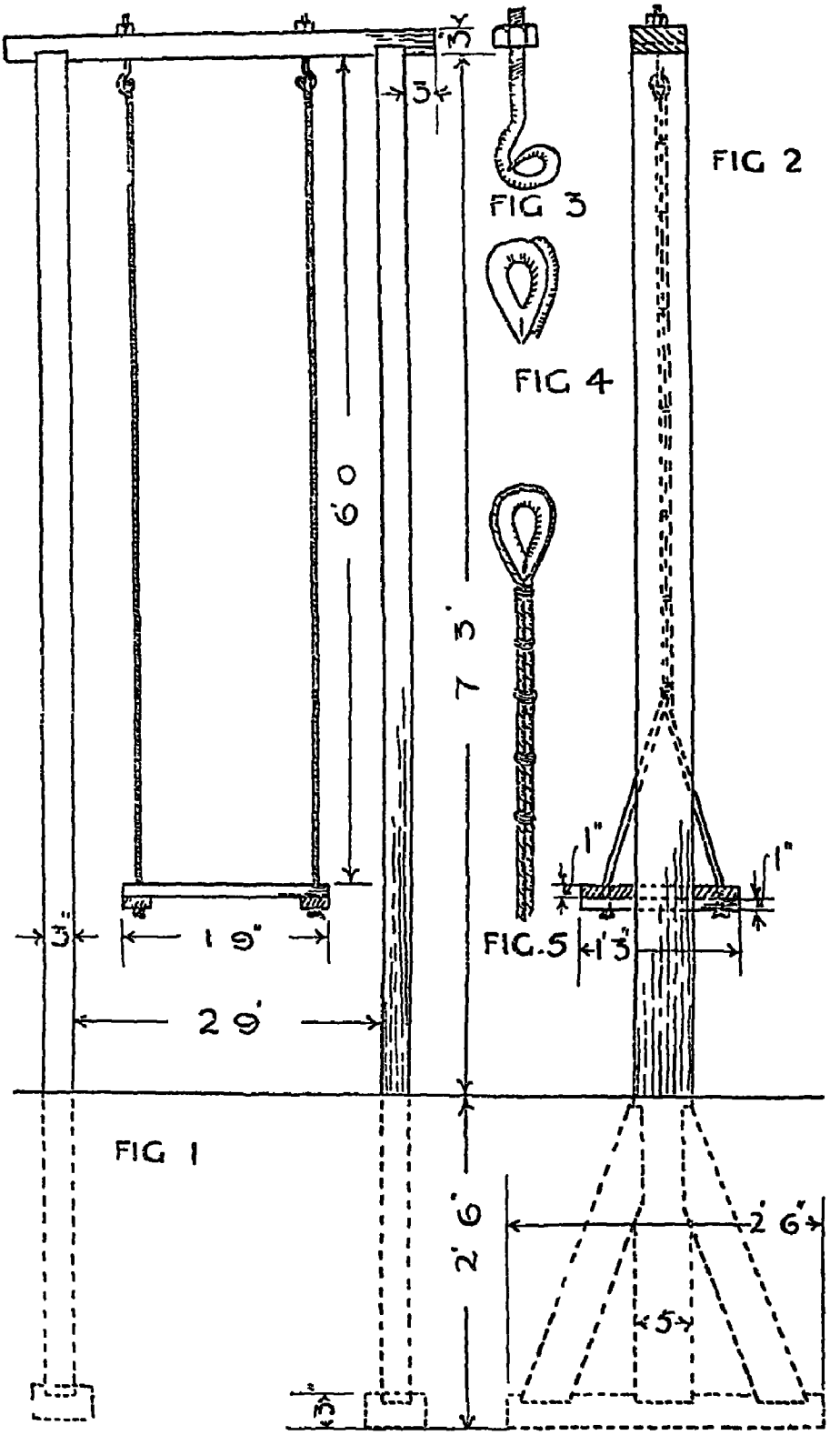


FIG 1

FIG 2

FIG 3

FIG 4

FIG.5

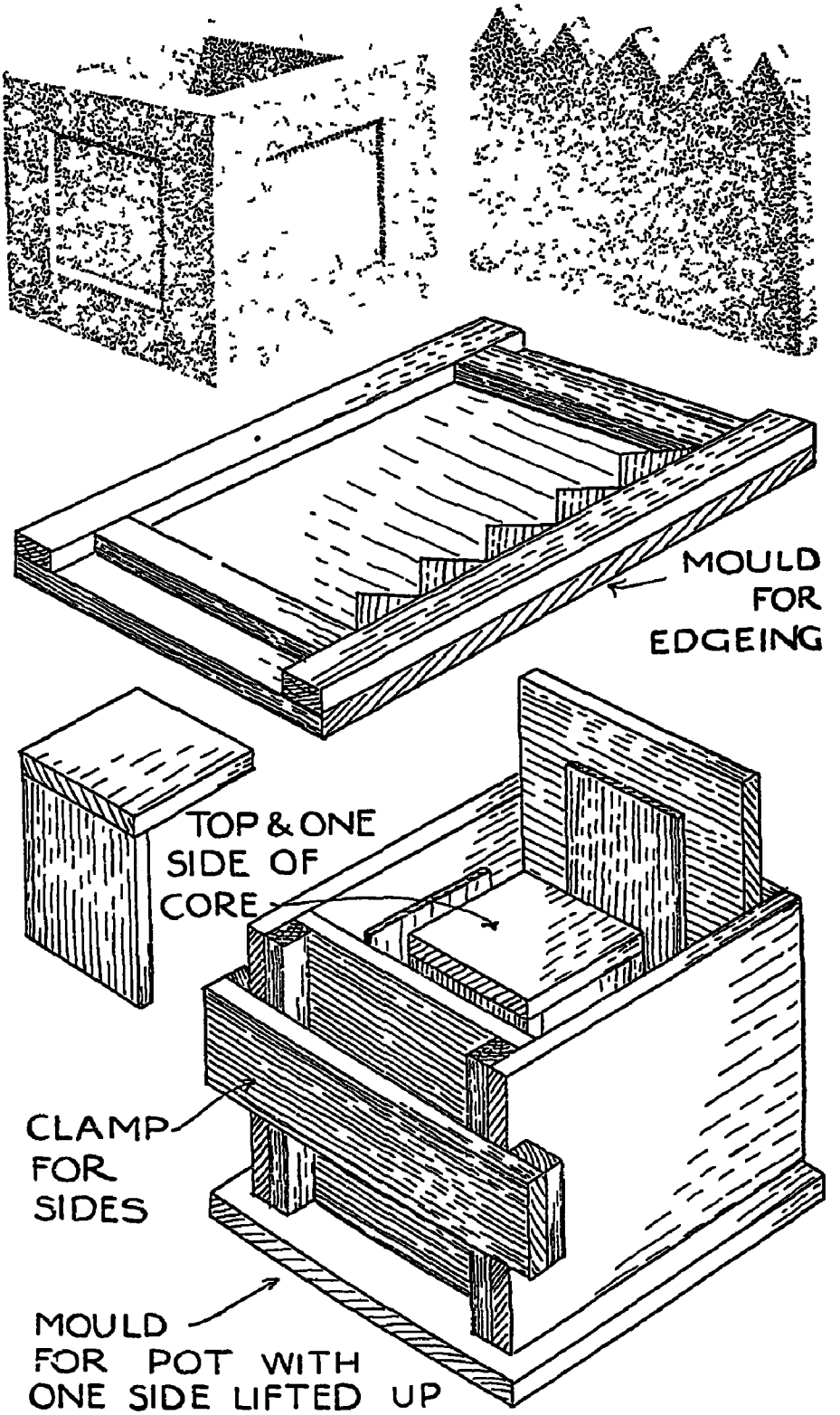
MAKING A POT AND GARDEN EDGING IN CONCRETE

The flower pot is made in a mould with a centre core, as shown, but it will be seen that there are certain recesses on each side—these are formed by tacking on strips of wood on the sides of the mould. First of all prepare two sides as shown at Fig. 2; these are 14 in. long, 11 in. wide, and $\frac{3}{4}$ in. thick. At each end nail or screw on stiffening strips of $1\frac{1}{4}$ in. by $\frac{3}{4}$ in. wood, 11 in. long, as indicated. The remaining pair of sides are 11 in. in height in the direction of the grain, 10 in. wide and $\frac{3}{4}$ in. thick. The base is 14 in. long, 11 in. wide and $\frac{3}{4}$ in. thick, and the clamps can be made from odd pieces.

Suitable dimensions for the edging are 18 in. by 6in. by $1\frac{1}{4}$ in. Prepare a base of 1 in. wood to $18\frac{1}{2}$ in. by 8 in. and nail on two side strips each $18\frac{1}{2}$ in. by $1\frac{1}{4}$ in. by 1 in. The two end pieces are made as shown, using wood similar to that used for the sides. The V-shaped openings are formed by $\frac{5}{8}$ in. square wood planed down to the diagonal.

The concrete is made by mixing 1 part of cement with 2 parts of clean sand and 3 parts of stone, gravel or ballast. A wooden box measuring about 12 in. in length, width and depth will form a good measure.

The mixing should be done on a large board rather than on the ground and the cement should be thoroughly incorporated with the other material. Water is poured over the mixture with a watercan fitted with a rose, and then thoroughly mixed. When the mixture is wet enough to hold together without excess of water, pour into the moulds.


MOULD
FOR
EDGEING
TOP & ONE
SIDE OF
CORE
CLAMP
FOR
SIDES
MOULD
FOR POT WITH
ONE SIDE LIFTED UP

A BOARD FOR CHESS OR DRAUGHTS

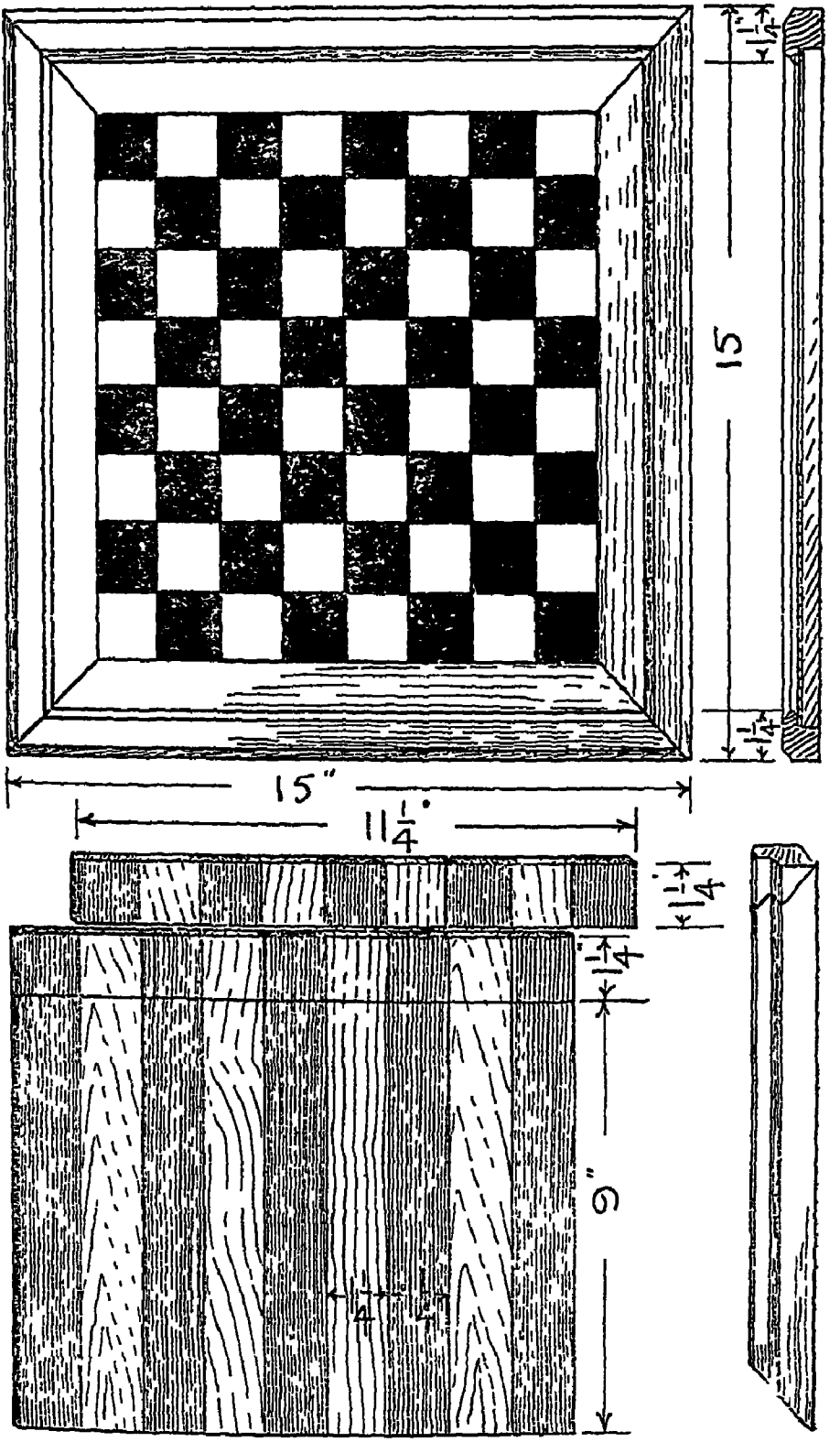
The illustrations on the next page show how to make a strong and lasting chess board. The bottom board may be built up with two pieces of $\frac{1}{2}$ in. board, but a piece of thick plywood is to be preferred, as there would be no risk of warping. The strips should, if it is possible to obtain it easily, be made of sycamore, one set of the pieces being left plain, the other being stained with ebony stain. The rim can be of any suitable wood.

Begin by preparing the strips, planing them up to $1\frac{1}{4}$ in. wide and using wood not more than $\frac{1}{4}$ in. thick. Eight strips will be required, and in order to make an exact pattern, each of the strips must be true in width. Prepare some stain and then coat four of the strips and allow the stain to enter deeply into the grain.

The strips are now glued together, one light, one dark, and so on; it is convenient to glue them on a large piece of paper. When the glue is hard, one end should be planed quite true and a $1\frac{1}{4}$ in. strip marked off and sawn apart. Continue until eight pieces are ready.

Prepare the base to about 13 in. by 13 in., and then glue the strips in order, placing the work under pressure, but being very careful that the joints are all close; this can be done if each strip as it is glued in position is rubbed down close to the base and the next strip.

Clean up the edges when dry and make up the border with some suitable wood, oak for example. The board is now enclosed in a picture frame moulding mitred at the corners and nailed on.


15
15"
11 1/4"
1 1/4
1 1/4
1 1/4
9"

HOW TO MAKE A FISHING ROD

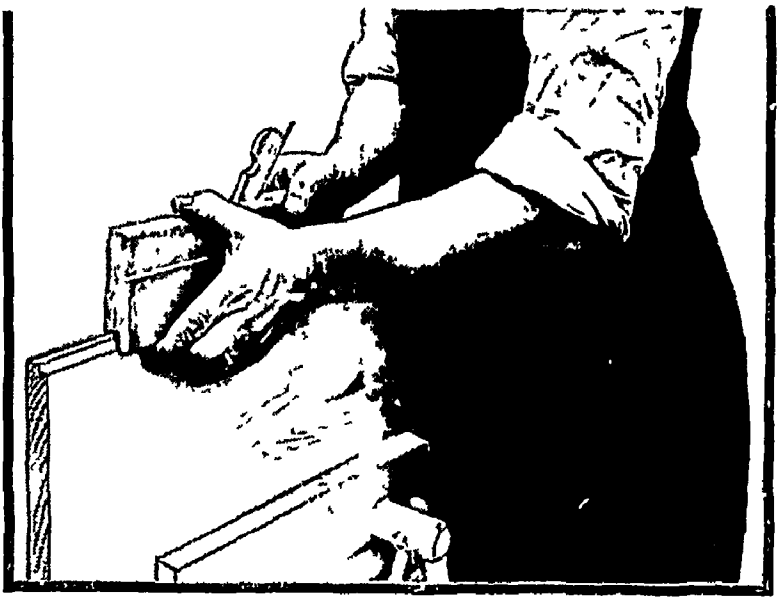
The main thing is to obtain suitable material. Ash is plentiful in some districts, and if there is a wheelwright near it should be an easy matter to get some odd lengths suitable for the purpose.

The sections may vary from 3 ft. to 4 ft. in length and should be arranged to suit the material. The butt end should be made from wood 1½ in. square, the remaining pieces in proportion. First plane the pieces true and square in section, and bring to a round on a board, as at Fig. 2, mark the ends as shown at A, in Fig. 3, and B. Plane off the corners as at C and D, then complete the round form with a plane as at E. The length is now tapered, finished with glasspaper.

Joints are made with suitable lengths of brass tubing, fitted to one length, the end of the other piece being shaped as at Fig. 4. Sections at Figs. 5 and 6 show methods of fixing the ferrules.

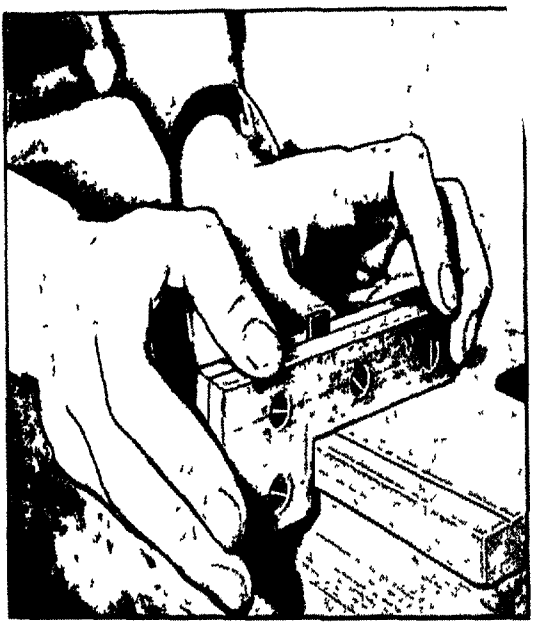
The top length of the rod should, if possible, be of greenheart. The method of attaching the reel is shown at Fig. 7; a recess is cut in the butt and suitable bands made of brass tubing. Loops can be made of paper fasteners as at Fig. 8, or hairpins as at Fig. 9. The ring at the tip of the top section should be formed as at Fig. 10.

In the event of any one of the sections being split, a suitable method of splicing is shown at Fig. 11. It should be noted with such a repair, unless carried out with silk is likely to disturb the balance of the rod. The same objection to increased weight applies to Fig. 13, which shows a method of repairing the butt with a length of thin tube.



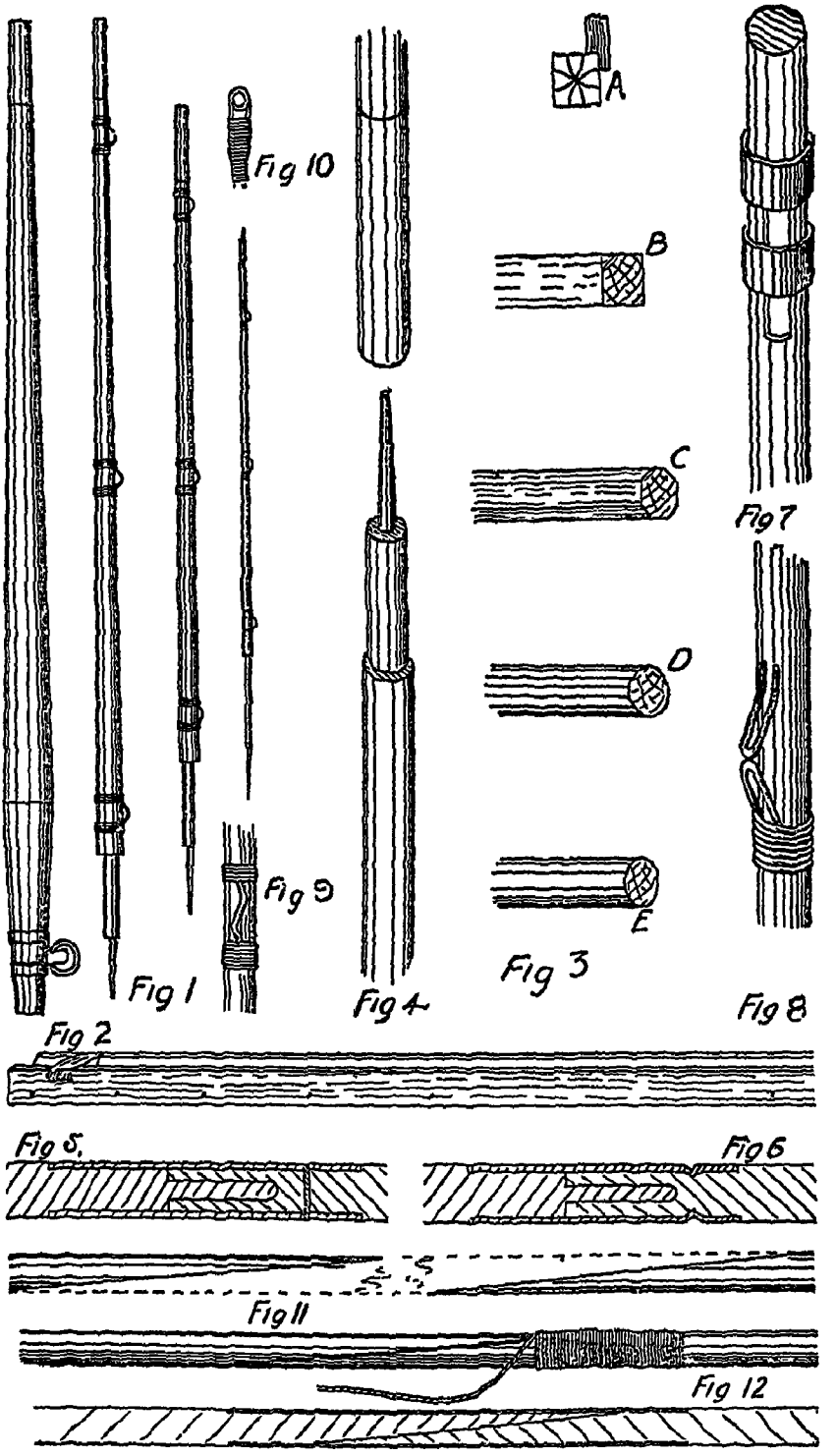
22 USING A BEADING PLANE

THE PLANE SHOULD BE HELD FIRMLY WITH BOTH HANDS, THE FINGERS OF THE LEFT HAND ACT AS A GUIDE THE REBATE PLANE IS HELD SIMILARLY



23 HOME-MADE BEADING PLANE

BY INSERTING A SUITABLY SHAPED CUTTER BETWEEN TWO PIECES OF HARD WOOD AS ABOVE, IT IS QUITE EASY TO WORK A BEAD


Fig 10
A
B
C
D
E
Fig 7
Fig 9
Fig 1
Fig 4
Fig 3
Fig 8
Fig 2
Fig 5.
Fig 6
Fig 11
Fig 12

A MODEL WINCH

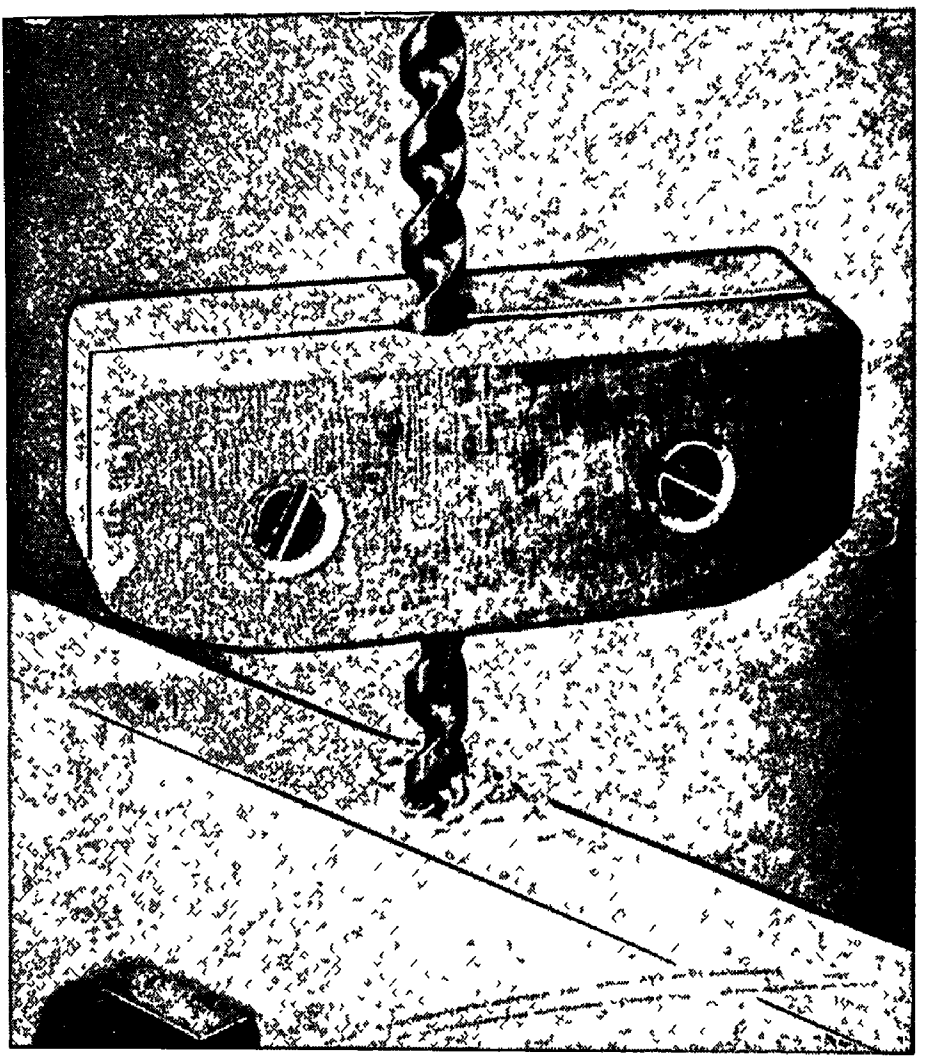
A winch is not difficult to make, one suitable for fitting to a model crane or for innumerable other purposes is shown at Fig. 1. The side view at Fig. 2, together with the end view at Fig. 3, and a plan at Fig. 4, gives all the sizes.

The parts are lettered and consist of a base A, measuring 4½ in. by 3½ in. by ¼ in., stiffened by two pieces B, 3½ in. by ¾ in. by ¼ in. The two upright sides C, 5 in. by 1¼ in. by ¼ in., are secured to the base by dovetail joints. Cut the joint on the sides and then mark out the sockets on the ends of the base, leaving the bottom of the uprights still 1¼ in. wide, and letting them in full depth.

The winding drum D is made from a piece of ¾ in. round, the flanges E should be 1¼ in. diameter and ¼ in. thick. Holes should be bored through the uprights so that the projecting ends of the drum are able to move easily without any play. Before the uprights are glued in position, prepare the handle and ratchet wheels.

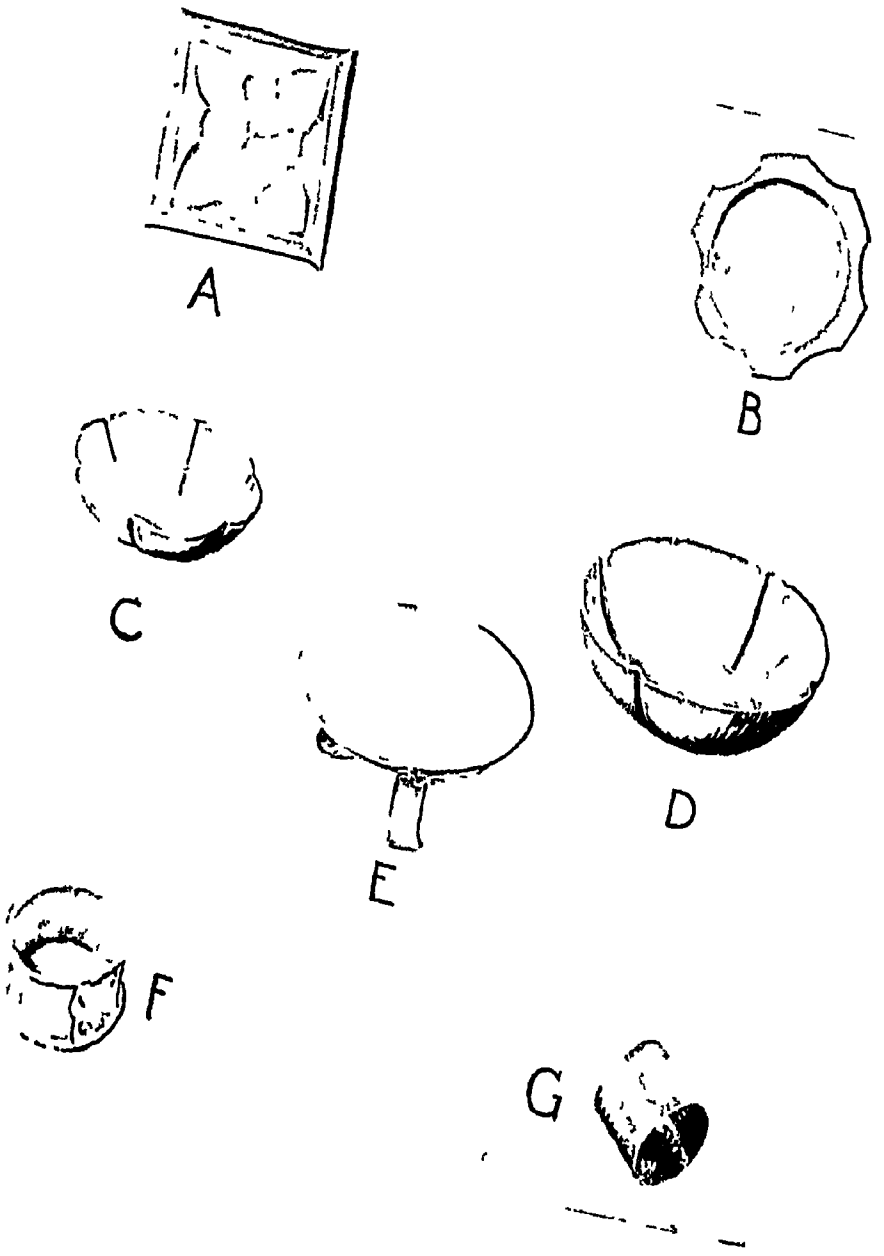
Procure a suitable cogged wheel F from an old clock. The wheel should be drilled so that it can be screwed to the drum and it should also be fitted with a length of ⅛ in. diameter galvanised wire, soldered on as at G. Now provide a ratchet wheel as at H, and a pawl as at J, which is fitted to the other end of the handle length.

Some care will be needed to set out the exact position of the holes for the handle length, the wire should be most carefully bent and just sufficient solder run on to secure the wheels to the wire.



24 DEPTH GAUGE

THE ABOVE PHOTOGRAPH SHOWS A SIMPLE DEPTH GAUGE FOR USE WITH A TWIST BIT BEECH IS A SUITABLE WOOD TO USE



25 EXAMPLES OF SIMPLE METALWORK

THE ASH TRAY AT 'A" IS QUITE SIMPLE THE HOLLOW SHAPE AT 'B' CAN BE BEATEN OUT INTO A HOLLOW CUT IN A BLOCK OF WOOD THE BOWLS AT "C" "D' AND "E" CAN BE MADE IN THE SAME WAY THE NAPKIN RINGS AT 'F' AND "G" ARE SHAPED ON A ROUND STAKE

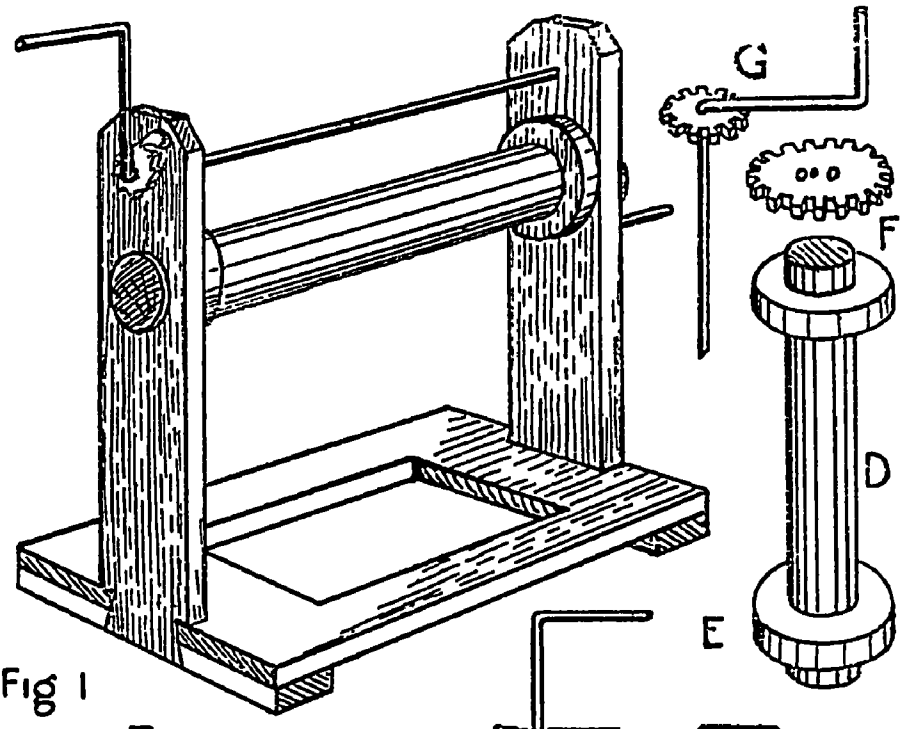
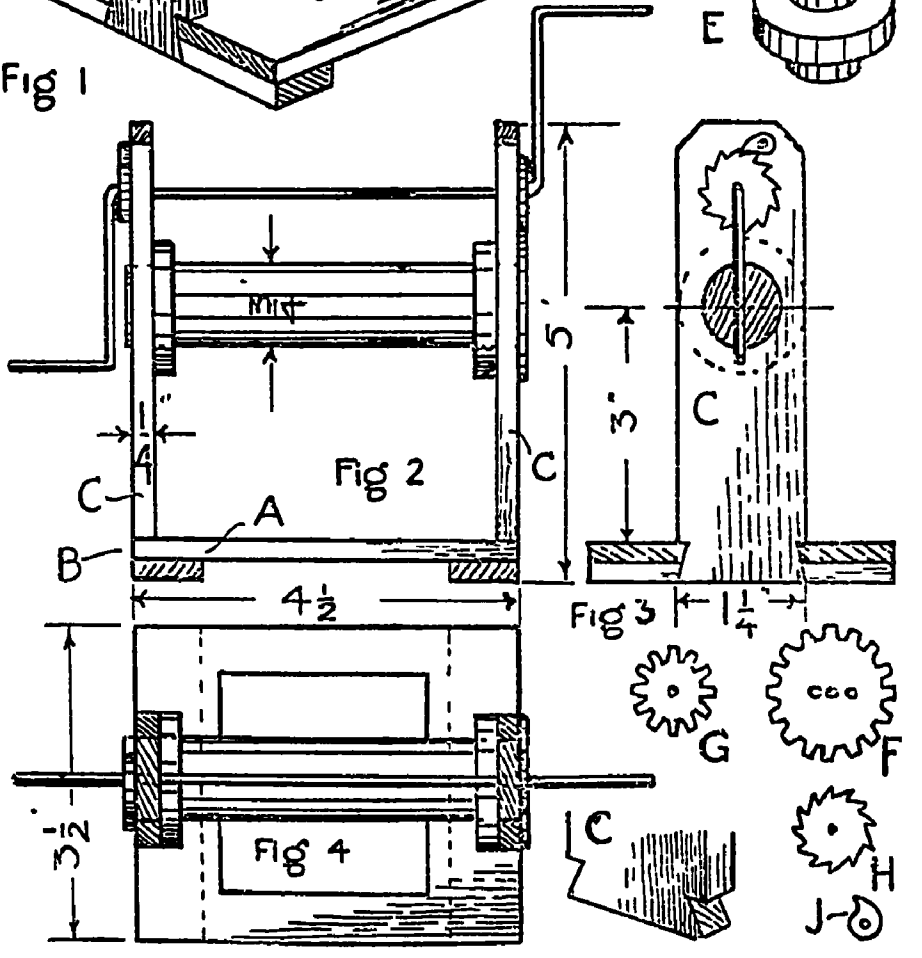
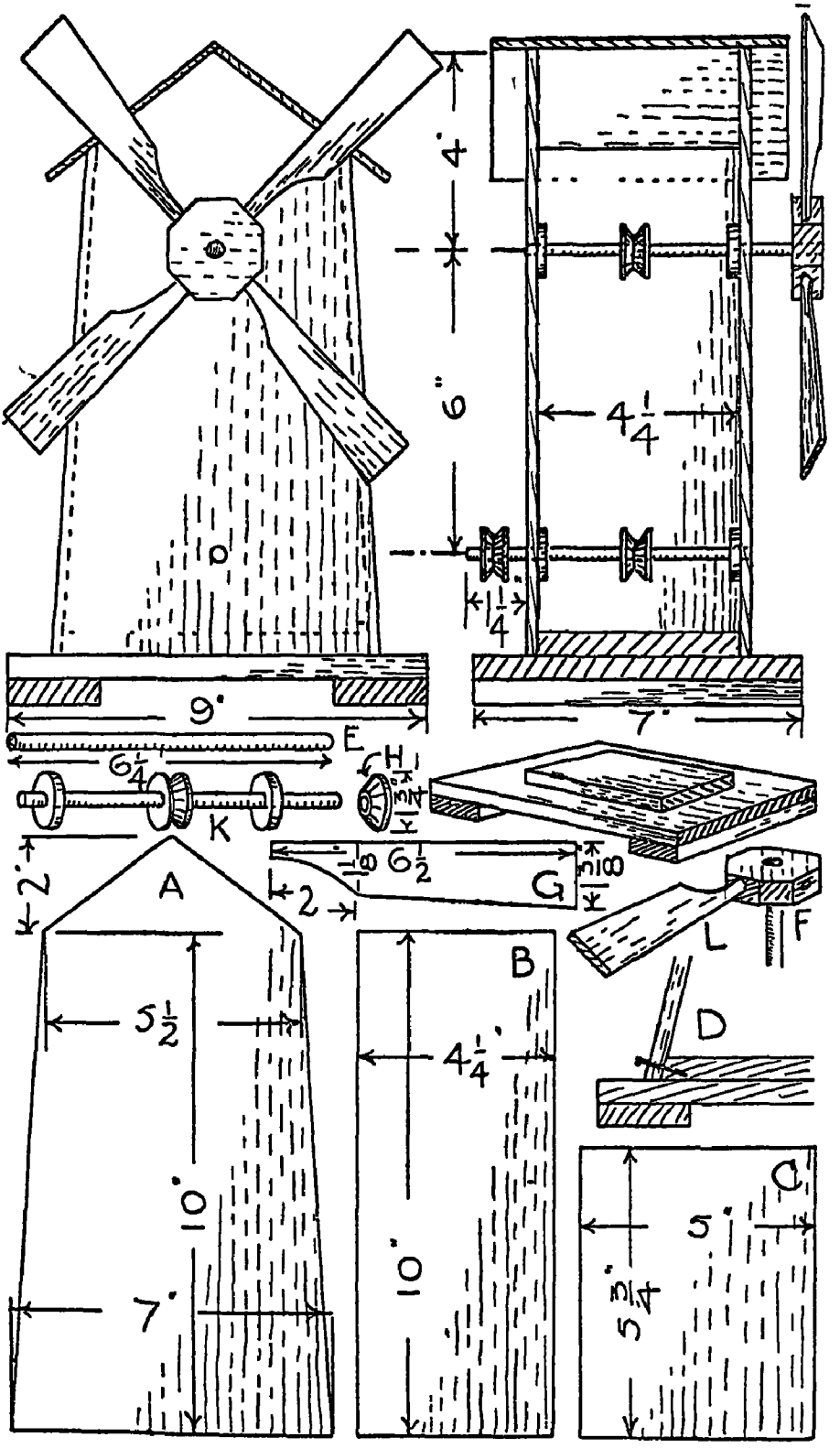


Fig 1



A WINDMILL

An easily made windmill is shown in front elevation and side section, and it will be seen that the vanes are attached to a boss joined to a spindle, and turn a pulley which is attached by a belt to another pulley, working on a spindle, to the outside of which is attached a third pulley. The front and back pieces of the house portion are made to the same size as shown at A in the diagram. The wood should be 12 in. by 7 in. by $\frac{1}{4}$ in. In marking the pieces out, a centre line should be drawn from top to bottom and a line drawn across 2 in. from the top. A distance of $2\frac{1}{2}$ in. should be marked on this line from the centre, and from the outside points lines can be drawn to the top to give the correct slope of the roof. The side pieces are shown at B and are finished to 10 in. by $4\frac{1}{4}$ in. by $\frac{1}{4}$ in. These four pieces should be placed together so that the correct slope on the top edges of the sides can be marked out and planed down so that the roof pieces will fit flat. The two pieces for the roof are cut to $5\frac{3}{4}$ in. by 5 in. by $\frac{1}{4}$ in. as at C, the front, back and bottom edges are quite square, but the top edge of each piece is planed to a slope so the apex will meet when the pieces are in position. The base of the model is made with $\frac{1}{2}$ in. wood, four pieces of wood are required, one is 9 in. by 7 in. On top of this piece is glued another piece, $6\frac{1}{2}$ in. by $4\frac{1}{4}$ in. by $\frac{1}{2}$ in., but the ends are planed to the same slope as the sides as at D, thus making the length measured on the top to $6\frac{7}{16}$ in. or perhaps a little less. The remaining pieces are 7 in. by 2 in. by $\frac{1}{2}$ in., and they are glued to the underside of the larger piece as shown. Provide two lengths of


4'
6'
4 1/4
1/4
9'
7'
E
6'
K
H
2'
A
2
6 1/2
G
L
F
B
D
C
5 1/2
10'
7'
4 1/4
10'
5
5 3/4

birch dowel rod $\frac{3}{8}$ in. diameter for the spindles. One length should be $6\frac{1}{2}$ in. long as at E, the other length being 6 in. The boss, F, to fit on the top spindle, and to which the vanes are attached, is $2\frac{1}{8}$ in. diameter and $\frac{5}{8}$ in. thick. It should be made from a piece of close grained wood. The vanes are cut from $\frac{3}{16}$ in. wood to $6\frac{1}{2}$ in. by $1\frac{3}{8}$ in., as at G. The slope is marked off 4 in. from the end to a width of $1\frac{1}{8}$ in. and from this point the wood is scooped out to give an end $\frac{1}{4}$ in. wide. Four equally spaced holes should be drilled in the boss, and drilled to a depth of $\frac{3}{4}$ in. with a $\frac{3}{16}$ in. bit. The pulley wheels are cut from $\frac{3}{16}$ in. wood to a diameter of $1\frac{3}{4}$ in. and drilled with the centre hole of $\frac{3}{8}$ in. diameter, those forming the wheels as at H should be chamfered on the inner edges so as to form a V-shaped groove when the two pieces are glued together. The holes in the plain pieces should be a fairly slack fit, but those in the pulley pieces should be a good fit. The pieces are arranged on the spindle as at K, but before this can be done the holes in the front and back pieces must be drilled. The plain wheels should be so placed on the spindles that they are exactly $4\frac{1}{2}$ in. from outside to outside, and the pulley wheels exactly in the centre between them; the top spindle projects 1 in. in front and $\frac{1}{2}$ in. at the back, and at the bottom the projection is 1 in. at the back. The upper part is screwed to the base and the bottom pulley and the top boss glued on the ends of their respective spindles. The vanes are fitted as at L, each vane being fixed at the same slope. The belt connecting the two inner pulleys is made with string and tied fairly tight.

STAINS AND STAINING

Staining lends itself to many treatments, from the darkening of floor boards to the decorative colouring of wood, either as an ornamental feature in itself, or as a means of imitating the colouring of an expensive wood on a light or inferior wood. It can be considered as an alternative to painting, but while paint obscures the original appearance of the wood, stain enables its natural beauty to be preserved. Stained wood can be finished by polishing or varnishing, the latter giving as sanitary and durable a surface as paint; but to obtain the best effect, it is important to prepare a perfectly smooth surface with glasspaper and to leave it quite clean.

There are four kinds of stain in ordinary use, these are known as water, oil, spirit and chemical stains; they are all more or less transparent and can be finished with polish or varnish. In addition, oil and spirit varnish stains are prepared for direct application. Some of the varnish stains are sufficiently opaque to be used on previously stained, varnished or polished surfaces, such as articles of furniture.

Water stains are formed by colour soluble in water and are of a transparent nature. Those in general use are vandyke brown, raw sienna, burnt sienna, raw umber, burnt umber and mahogany lake, this selection covers a range of browns and reds; blue-black and indigo supply blues, yellow lake and gamboge form good yellows, a good green is found in terre vert and a black in logwood. Many aniline dyes are suitable and supply a large range of intermediate colourings. Water stains

are inexpensive and suitable for many purposes, but they have a tendency to swell the grain of the wood. To prevent the grain rising up under the action of the stain, the wood should be damped with clean water, allowed to dry and then rubbed with glasspaper to a smooth surface. Water stains can be mixed with a weak size solution when applied to wood of a porous nature, but as a rule it is better to apply it pure and not too strong. If a deep shade of the colour is required, two or more applications are preferable to one deep stain which is apt to show uneven patches when dry.

Water staining must not be confused with water coating in which the body colour, and not the transparent colour, is mixed with size and applied to the wood. In this method of staining, the natural grain of the wood is hidden, but it is useful when large surfaces have to be coloured quickly in a manner similar to that employed in distempering; it should not be used for good work.

Spirit stains are composed mainly of aniline dyes and pigments easily dissolved in spirit or naphtha; they are obtainable in liquid form, or as powder to be dissolved in methylated spirit. They are more expensive than water stains, and as they dry very quickly are more difficult to apply, but a great variety of most brilliant colourings are available. The stain should be applied freely and evenly, but the edges of the stain should not be permitted to dry until the whole of the surface has been covered. If this is not attended to, it will be difficult to avoid lines of a deeper colour at places where the wet stain has joined a dry portion. The staining should be done across the

narrow portion of the work, beginning at the top and a pool of liquid stain should be kept on the move until the whole of the surface is covered.

Oil stains are made with the same pigments as used in water stains, but the vehicle is composed of 1 part of linseed oil, 2 parts turpentine and ½ a part of liquid driers, the only difference in the colours being that they are ground in oil instead of water. The stain is easily applied and it penetrates deeply into the wood; it requires a day or two to dry, but it takes any kind of finish. It is admirably adapted for amateur use particularly on porous wood. With hard woods a little more turpentine can be used, and for very porous woods the proportion of oil can be increased slightly.

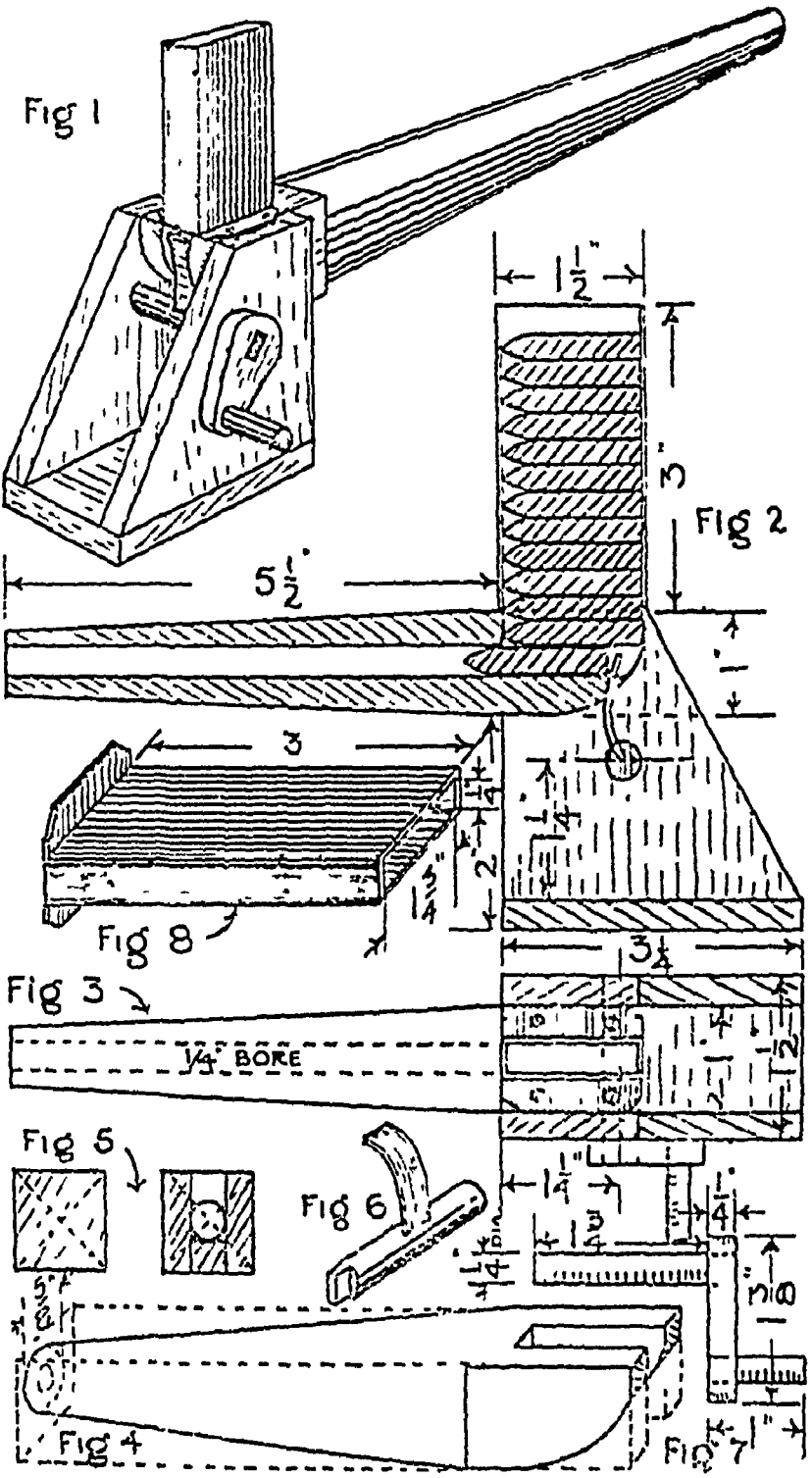
Chemical stains are generally colourless liquids which change the colour of the wood to which they are applied; ammonia and iron sulphate are examples of liquids capable of darkening wood, and the fumes of ammonia are utilised for darkening oak. Permanganate of potash is another example of a chemical stain, the crystals are dissolved in water and the liquid will impart a rich reddish-brown stain.

Oil varnish stains are more simple to apply than varnish stains made with spirit, the latter are more or less opaque and can be used on all kinds of polished furniture or even on painted surfaces.

Wax stains are easily made by adding powder colours to a mixture of beeswax and turpentine; wax is a good polish for hardwoods, especially oak, and it can be used on top of an oil or water stain to obtain a deeper colour; it will also impart a rich effect to the surface.

A SPRING-OPERATED TOY MACHINE GUN

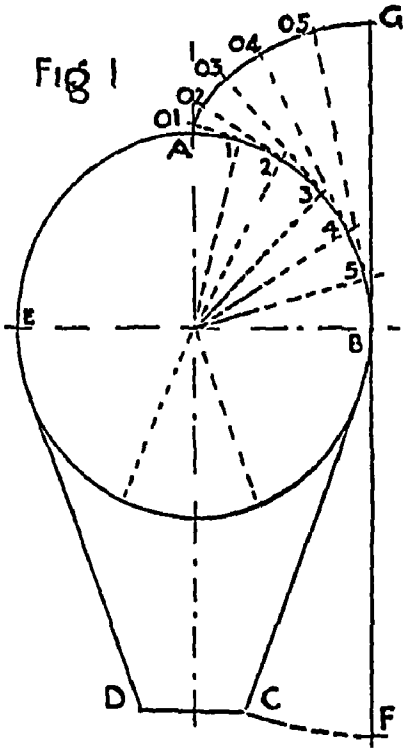
A machine gun, firing wooden ammunition as fast as the crank can be turned, is shown at Figs. 1 and 2. The wooden gun barrel is turned down to 7 in. by 1 in., tapering to $\frac{5}{8}$ in., and bored $\frac{1}{4}$ in. diameter, as at Figs. 3 and 4. A slot is cut near one end, reaching down to the bore, as at Fig. 5, to allow the ammunition to drop from the magazine into the barrel. The underside of the barrel is rounded off for the spring which must pass under from the rear. The barrel is mounted between two supports attached to a base. A piece of stiff clock spring, as at Fig. 6, is fastened into a slot cut in the shaft, which is a round piece of hard wood. It is fastened by riveting a small brad through the wood and a small hole punched in the spring. The shaft is mounted below the rear end of the gun-barrel, so that the spring will slip against the lower "shell," after first catching on a projection left in the upper part of the barrel. When the crank on the shaft is turned, the spring strikes this projection, bends backwards, then slips forwards with a jerk. The shaft is held at exactly the right point to keep the spring in place, by putting a cotter pin in each end, with a washer between each pin and the support. The crank may be either a piece of sheet metal with a small bolt for a handle, or a piece of wood with a wooden handle, as at Fig. 7. The end of the shaft is cut square so that it will turn with the crank. For a magazine, a piece of tin is bent and soldered into a shallow box, 3 in. by $1\frac{1}{4}$ in., with open ends. Lugs are provided to keep the magazine in place, as at Fig. 8.


Fig 1
1½"
3"
Fig 2
5½"
1"
3
1¼"
2"
1¼"
1¼"
Fig 8
3¼"
Fig 3
¼" BORE
1½"
2"
Fig 5
Fig 6
1¼"
1¾"
1¼"
3"
1"
Fig 4
Fig 7

HOT AIR BALLOONS

Balloons made of tissue paper and inflated by means of hot air are easily constructed. The first thing to do is to provide sufficient tissue paper and then to mark out the shape of the gores.

Taking a diameter of 3 ft. as a useful size, set out the diagram at Fig. 1 with a quadrant AB divided into six parts and the lines O1 to G drawn tangent to the several radii. Mark off lengths A1 on O1, from 2 to O1 on O2, from 3 to O2 on O3 and so on. The total length of the gore is from G to F and the shape of the sides is obtained as at Fig. 2. BG is divided into six parts, two similar spaces being marked below as at 6 and 7. The widths are taken from the triangle, HJ being $\frac{1}{8}$ of the circumference enclosing 45°; 6 and 7 being equal to 5 and 4. The bottom is similarly marked off. Make the pattern in brown paper and then cut out the gores 1 in. wider all round, pasting the tissue sheets together to make up the necessary size. When the 8 gores, Figs. 4 and 5, are ready, and they are more effective when in different colours, paste them together, taking care that the pieces do not stick together anywhere but at the seams. Paste a circular piece on top, and paste the bottom to a wire ring as at Fig. 5, this can be made from galvanised wire. Attach some cotton wool to the ring or find a small tin lid as at Fig. 6, and tie it with fine wire to the ring. It does not matter if the wire passes over the top of the lid. When the balloon is ready, as shown at Fig. 8, swing it round in the air to fill it out, then pour a little methylated spirits on the cotton wool, light it and hold until the inside air is quite hot.


Fig 1
G
05
04
03
02
01
A
1
2
3
4
5
E
B
D
C
F

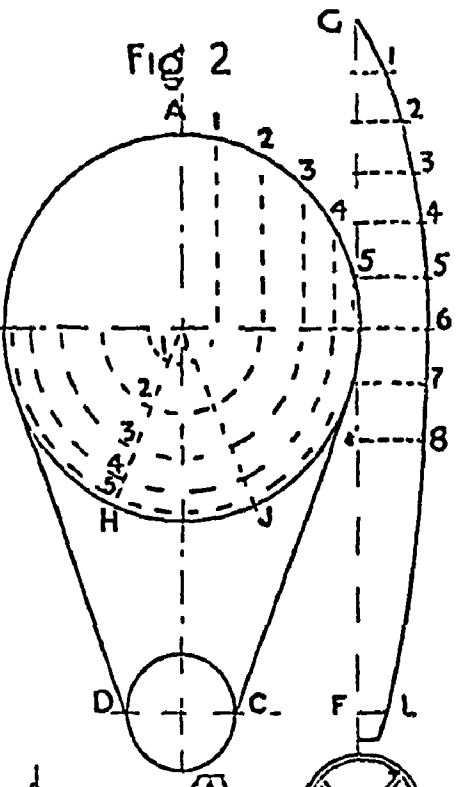
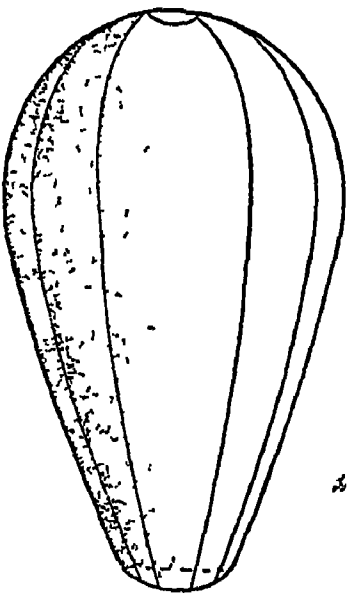

Fig 2
A
1
2
3
4
5
G
1
2
3
4
5
6
7
8
H
J
D
C
F
L


Fig 5


Fig 8

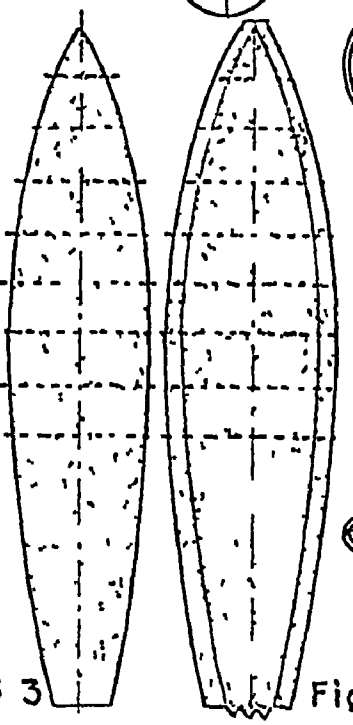

Fig 3
Fig 4


Fig 6


Fig 7

HOW TO MAKE A PAIR OF STILTS

It will be seen at Fig. 1 that the top of the stilt is rounded to form a handle, the height of the stilts is not important so long as the distance between the top and the footrest is the same as the distance from the elbow and foot of the user. Generally it will be found convenient to make the length equal to the distance between the shoulder and the foot.

The height of the footrest from the ground should be from 1 ft. to 2 ft.; it is not advisable to have a greater distance than this, 18 ins. is the usual amount. The best method of securing a fix footrest is to notch it into the upright, but the adjustable rest is very convenient.

Prepare the uprights from $1\frac{5}{8}$ in. by $1\frac{1}{4}$ in. wood, from a mark 12 in. or 18 in. up set out a distance of 14 in., as shown at Fig. 2. An enlarged detail of the marking for the notches is shown at Fig. 3, together with a finished view. The rests are shown at Fig. 4, the wooden portion is cut from hardwood, 15 in. by $3\frac{1}{2}$ in. by $1\frac{1}{4}$ in., and the two pieces are marked out as shown at Fig. 5.

The links which attach the rests to the uprights are made of $\frac{1}{4}$ in. diameter iron rod; they should be forged to the shape and sizes given at Fig. 6.

Care should be taken to shape the uprights as smooth as possible. The ends should be marked to a circle and as much of the waste wood as possible planed off; finishing can be done with a spokeshave. Clean up the work thoroughly with glasspaper, particularly the upper position of the uprights. Finish with varnish and paint the links.

5'-10"
3½"
8"
12"
Fig 1
¼" ROUND
2¾" APPROX
Fig 6
½"
2"
2'
2'
2'
2'
2'
⅝" DIA
45°
14"
1⅝
Fig 3.
Fig.5
Fig 4
Fig.2
5'-10"
3½
1¼
1¼
1¼
14"
8"
¼
¼
⅝

HOW TO MAKE MODEL AEROPLANE PROPELLERS

There are several methods of making model propellers for aeroplanes, the easiest and quickest is to use thin wood, veneer is quite suitable, and shape it from a piece as at Fig. 1. If veneer is used, it can be cut and shaped with a sharp knife and it is better to use a close-grained hardwood. The piece of wood should be steamed or placed in boiling water for some minutes and then fixed in a frame as shown at Fig. 2. This frame should be made to suit the length of the propeller and should be about the same width as the blade. The blocks at the end should be nearly right angle triangles with a curve as shown. The steamed wood is placed in the centre slot and then the blades tied, as shown at Fig. 3, to the two curved blocks at the ends, and left until quite dry.

The propeller should be smoothed with glass-paper and polished; the smoother the surface obtained the better. Shellac varnish gives a suitable protective finish. French polishing is the best way to finish propellers.

Another method of making a propeller is to carve it out of a block of wood as at Fig. 4. The centre hole should be bored and a diagonal marked on the ends in opposite directions. With a pocket knife, a rasp, file and glasspaper it is possible to make a propeller as shown at Fig. 6. The built-up propeller at Fig. 7 is made of a number of strips of thin wood, strung on a length of wire and glued together. When the glue has set, the ends can be marked out as shown and the edges cut away with chisel, rasp, and file and finished with glasspaper.

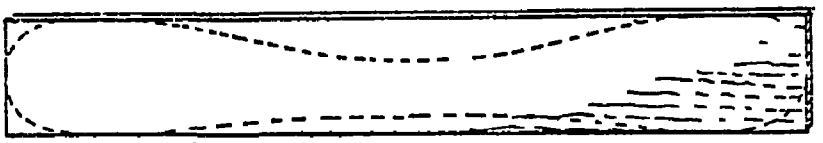


Fig. 1

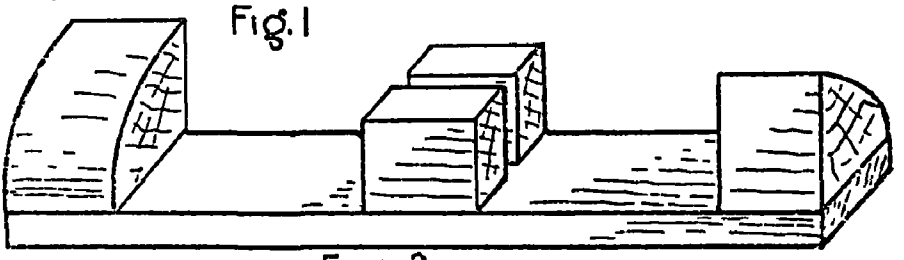


Fig 2

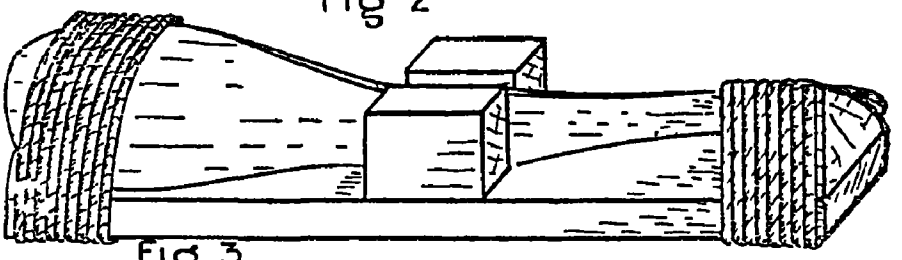


Fig 3

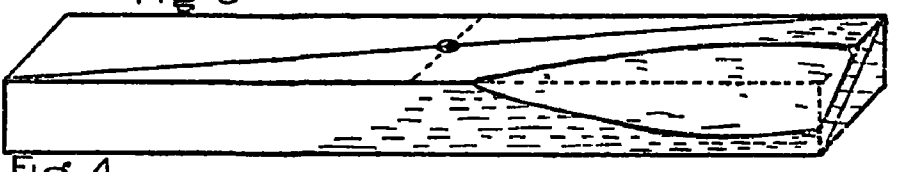


Fig 4

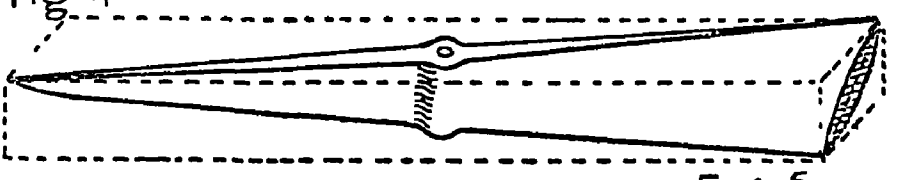


Fig 5

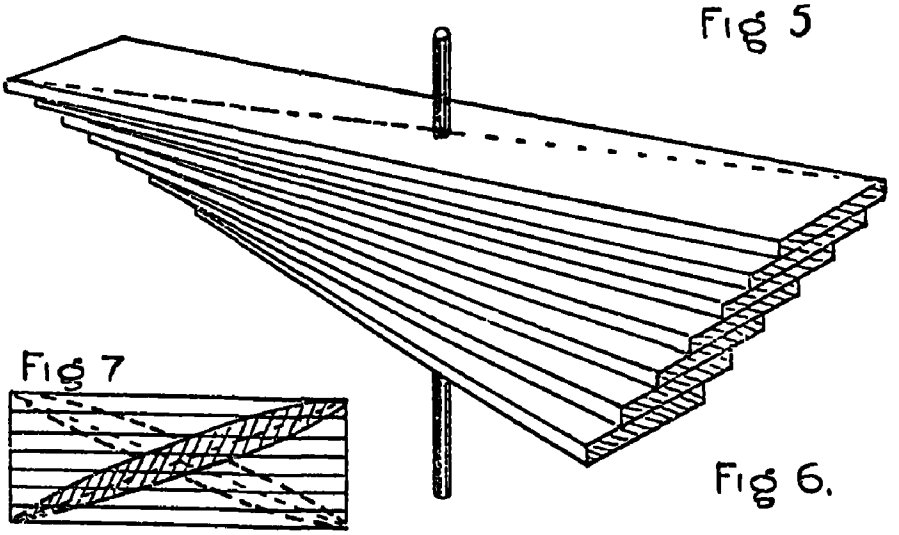


Fig 6.

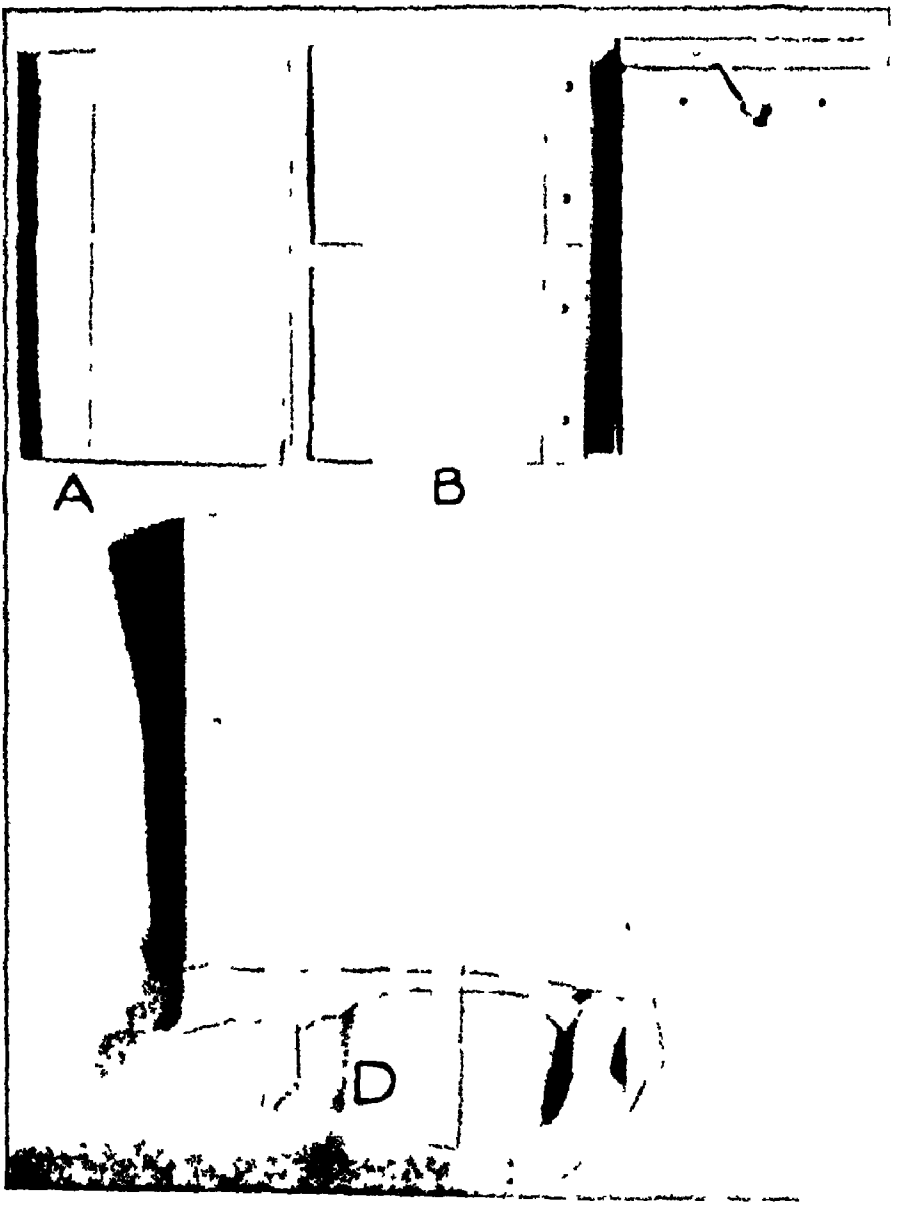
Fig 7

A TOY MOTOR BOAT

The toy speed boat at Fig. 10 will be found suitable for use on a small pond, a stream or a seaside pool. A convenient size would be a length of 10 in., a width of $2\frac{1}{2}$ in., and a depth of $1\frac{3}{4}$ in. Balsa wood will be found ideal.

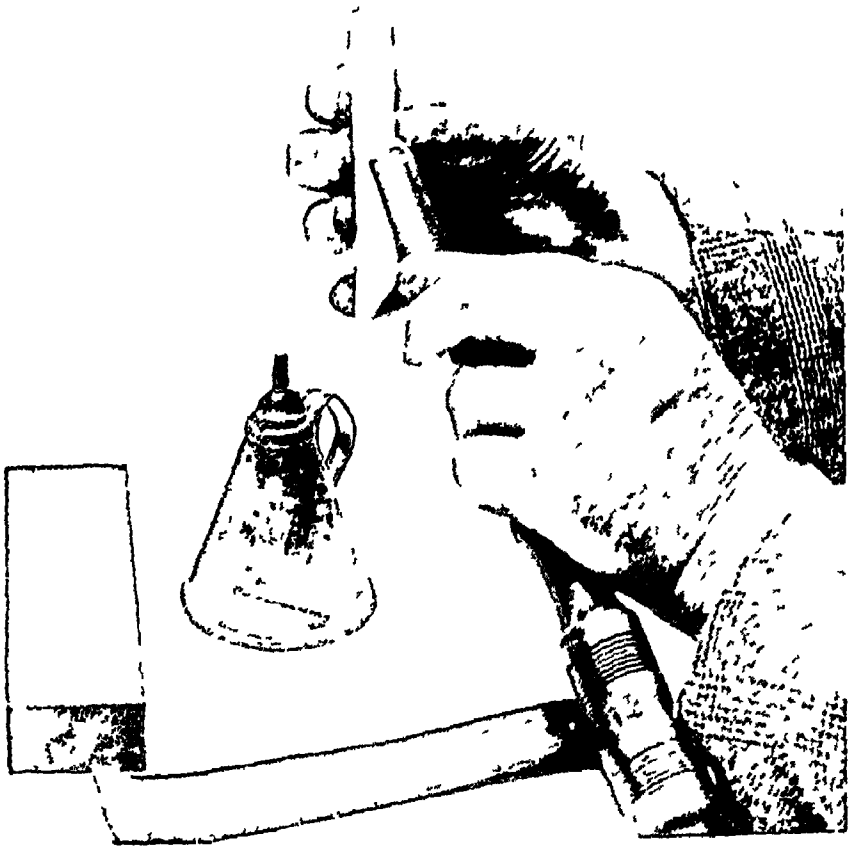
The motive power is derived from two lengths of twisted rubber attached to propellers, and the weight of the rubber does not amount to more than the wood can support, there is no reason why many different sizes and shapes should not be experimented with. The formation of the hull should not cause much trouble, the top is recessed as at Figs. 1 and 2, a saw cut is made in the centre and the sloping portion of the hull can be cut out with chisel or saw, as at Fig. 3. The hull should be finished as smooth as possible and will look like the diagram at Fig. 4.

The support for the propellers, as at Fig. 6, can be made of brass wire about $\frac{1}{8}$ in. diameter, but to allow for the strain of the twisted rubber the sides of the supports should be flattened out with a hammer on a flat piece of iron. The same applies to the front supports or hooks for the rubber as shown at Fig. 5. The propellers are made of either tinned sheet or sheet brass to the shape shown at Figs. 7 and 8, the latter material is much more satisfactory. The hooks at Fig. 9 should be stiffened by hammering on the sides and they should be fitted with small glass beads to act as bearings, as indicated at Fig. 8. Coat the boat with shellac varnish when finished, applying two coats at least.



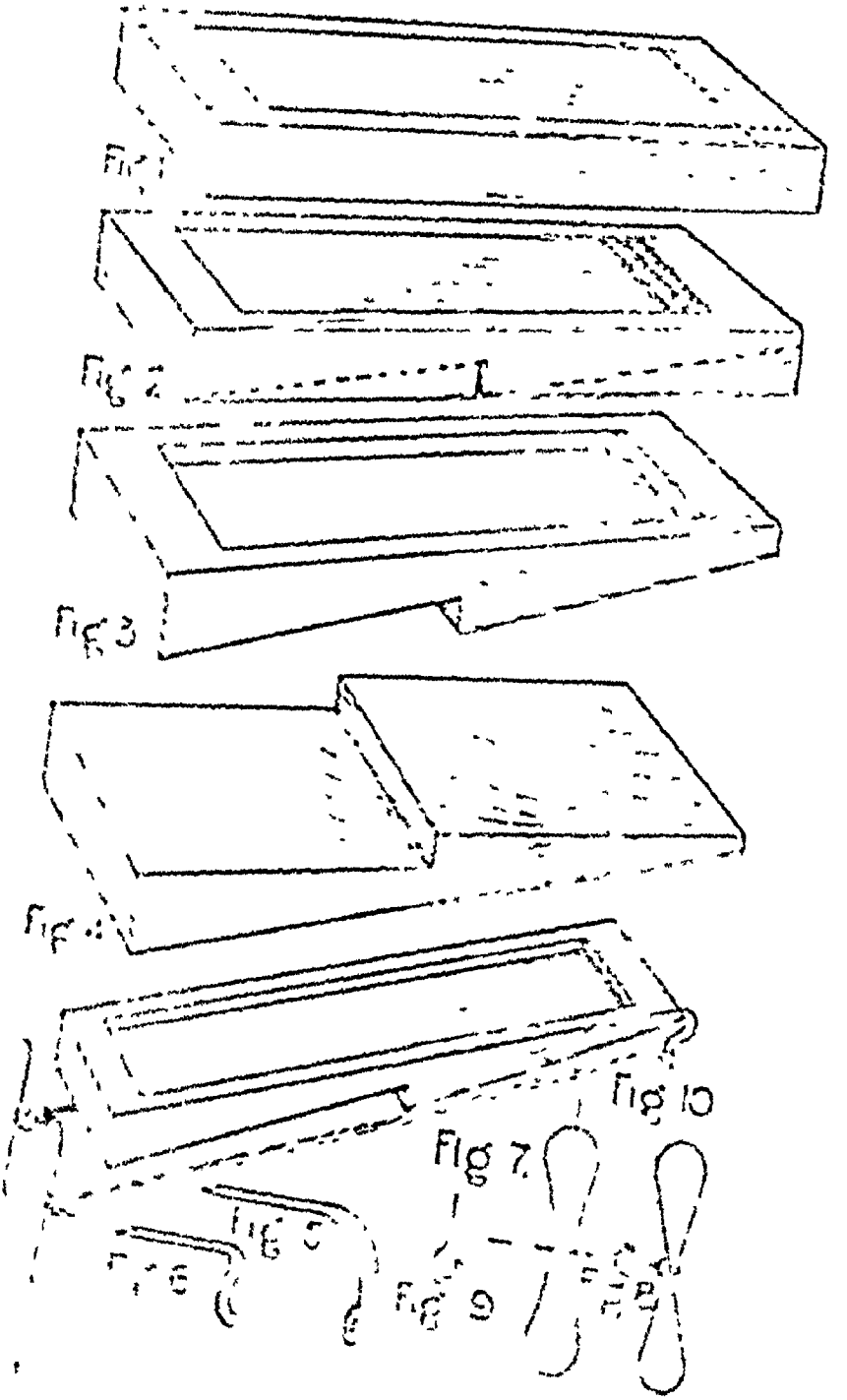
26 EXAMPLES OF SIMPLE BOOKBINDING

THE CASE AT "A" IS MADE BY THE METHOD DESCRIBED ON PAGE 150 THE COVERS AT "B" ARE USEFUL FOR NOTE BOOKS THE EXAMPLE AT "C SHOWS A DOUBLE FOLD "D" SHOWS A TAPE SEWN BOOK READY FOR THE COVER



27 SHARPENING WITH A GOUGE-SLIP

GOUGES AND CARVING TOOLS SHOULD BE KEPT SHARP THE GOUGE-SLIP IS A SMALL OILSTONE WITH ROUNDED EDGES LUBRICATE THE STONE WITH A LIGHT OIL AND CLEAN IT AFTER USE


Fig 3
Fig 7
Fig 10

SAND WAGON AND RAKE FOR THE SEASIDE

Begin by making the box first, a convenient size being 10 in. by 6 in. by 2 in. The wood need not be more than $\frac{1}{4}$ in. thick, but it would be better to make the two ends of $\frac{1}{2}$ in. wood.

When the box is ready, provide two rollers, these need not be more than 1 in. diameter, a broomstick will supply the material. The supports should be of strip iron, measuring in section $\frac{1}{4}$ in. by $\frac{1}{8}$ in. The iron can be bent quite easily when it is red hot, but with care it can be bent cold. Screw the supports to the bottom of the box and attach the rollers with round headed screws. Finish with paint or varnish and drive a stout screw-eye in at one end.

The sand rake will be welcomed by the little ones. A useful size would be a length of 7 in. with a handle about 15 in. long. First prepare the head to 8 in. by 2 in. by $\frac{3}{4}$ in., using hardwood for preference. Plane the wood smooth and plane off a bevel on the top, leaving $\frac{1}{4}$ in. or so on top and work down for about $\frac{3}{4}$ in.

Obtain some birch dowelling $\frac{5}{16}$ in. diameter, and cut off eight lengths, they should be $2\frac{1}{4}$ in. long and finished smoothly at both ends. Find a centre bit to bore a hole of the exact size of the dowels, then set out the position of the holes on the head, spacing them apart equally.

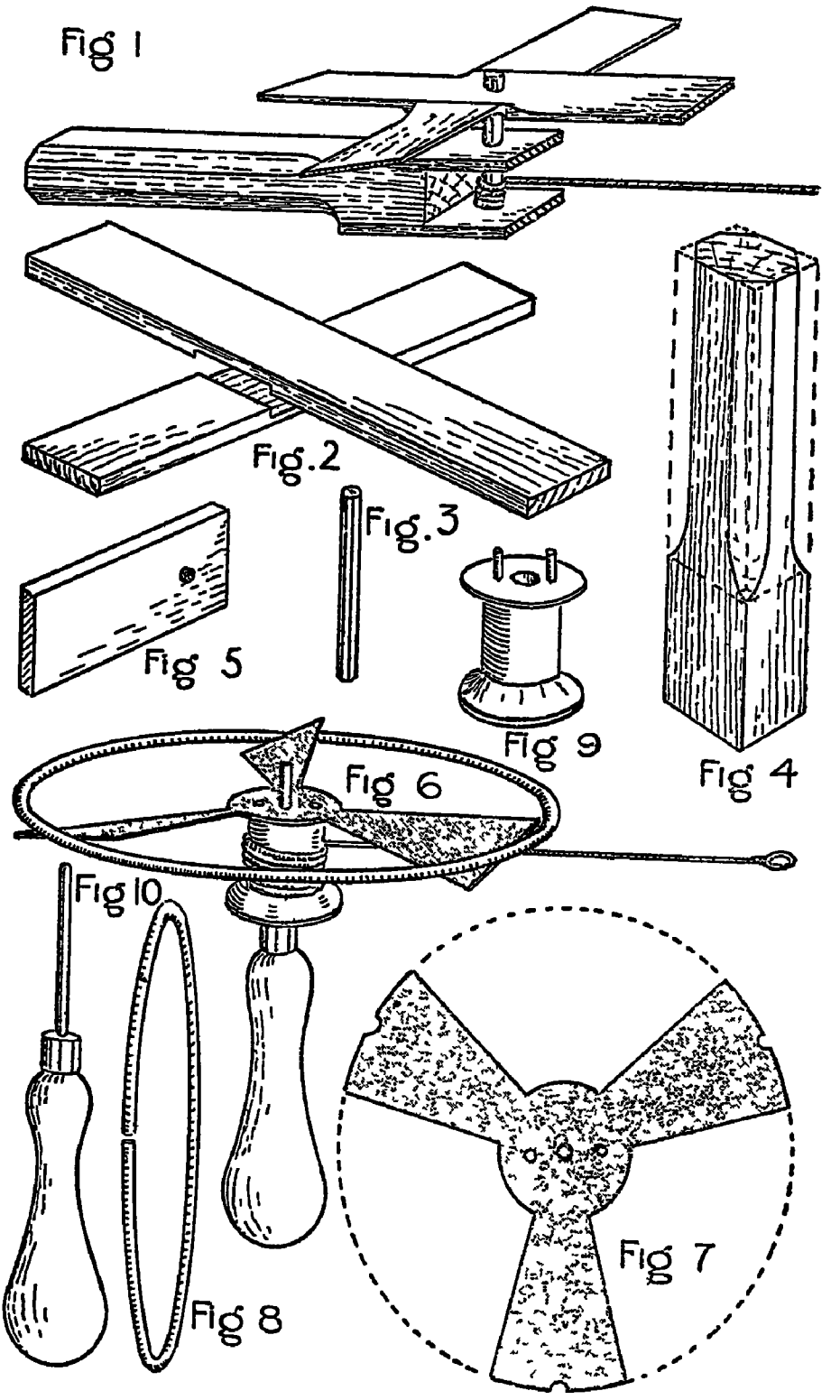
The holes should be bored to a depth of $\frac{3}{4}$ in., and when the dowels are glued in they will project $1\frac{1}{2}$ in. If the holes are slightly small, rub the dowels with glasspaper. Bore a hole for the handle and then fix it with a screw.

TWO FLYING TOYS

The vanes of the wooden flyer at Fig. 1 should be made of hard wood if possible. The two portions are halved together as at Fig. 2 and should be about 8 in. by $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. or $\frac{3}{8}$ in. The ends should be marked with a diagonal line and the waste wood pared off with a chisel or knife.

The birch spindle, as at Fig. 3, should fit tightly into the centre of the vanes. The holder can be made from a 6 in. length of $1\frac{1}{2}$ in. wood with the sides shaped as at Fig. 4; two $\frac{1}{4}$ in. thick pieces are glued and screwed to opposite sides, the top piece being bored to take the spindle as at Fig. 5, and the under piece bored half way through so that the end of the spindle can rest in it while it is being wound up. Fit a ring to the end of the string and rub a little blacklead in the holes. In use, the string is wrapped tightly round the spindle and then pulled sharply.

The metal flyer at Fig. 6 consists of a piece of tinned sheet about 5 in. diameter, about 16 in. of brass or galvanized wire, a cotton reel, some extra wire and an old bradawl handle. The ring at Fig. 7 is quite simple, the vanes, at Fig. 8, should be of the same diameter as the ring. Make the outside of the vanes $1\frac{1}{2}$ in., the inner circle $\frac{3}{4}$ in. diameter and the inner width of the vanes $\frac{5}{8}$ in. Three holes are drilled through the centre to fit on the wire. The reel, at Fig. 9, should fit easily on the length of wire which is driven into the bradawl handle as at Fig. 10, and two short lengths of wire are driven into the top of the reel to match the holes in the vanes. File a nick in the outer edge of the vanes, fit on the wire ring and solder.


Fig 1
Fig.2
Fig.3
Fig 4
Fig 5
Fig 6
Fig 7
Fig 8
Fig 9
Fig 10

REPAIRING CRICKET BATS

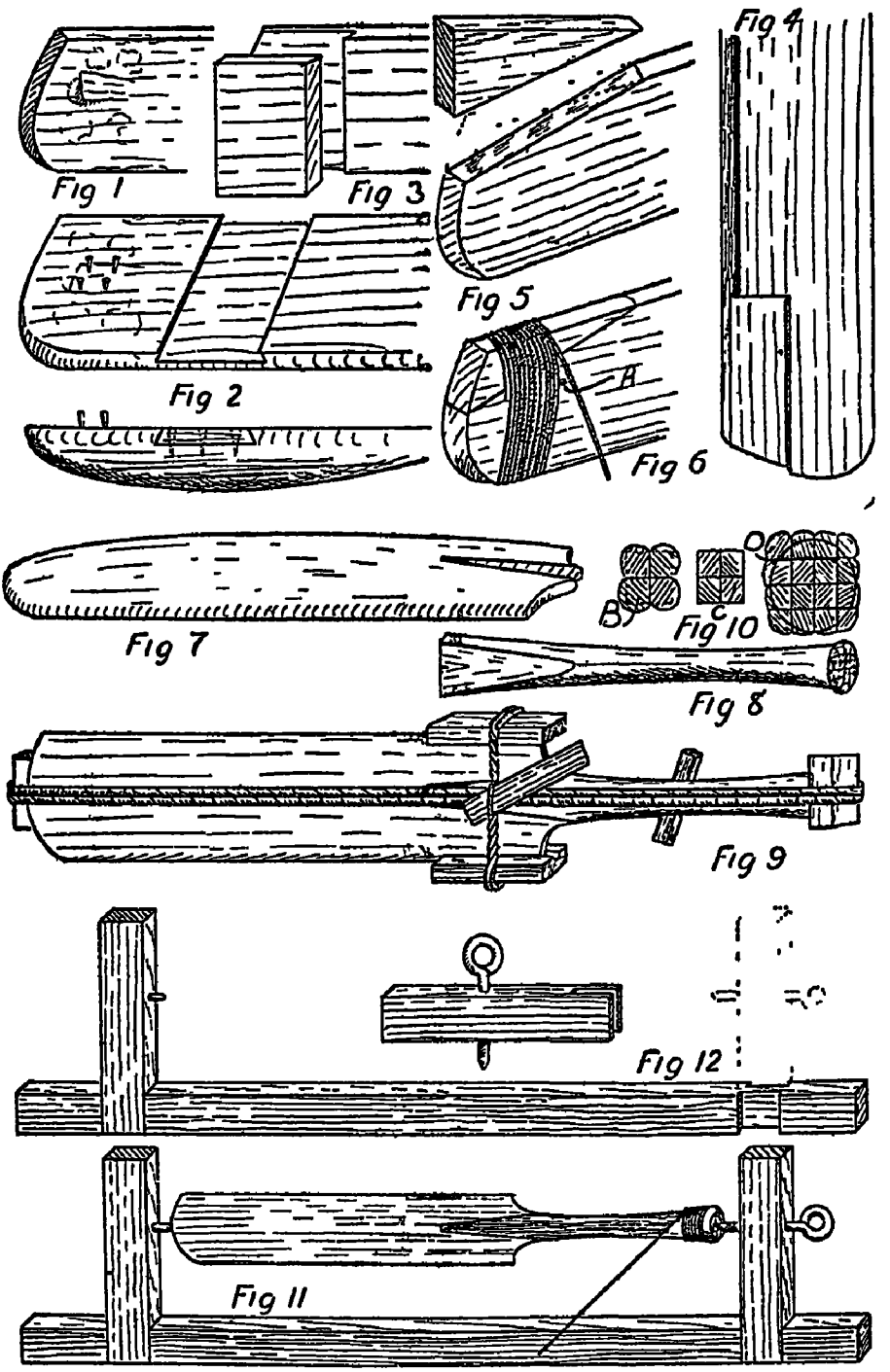
A frequent repair is that shown at Figs. 1, 2 and 3. The constant bruising of the fibres breaks down the wood and if pegging as indicated at Fig. 2 is insufficient to make the surface good, it may be necessary to let in a piece of wood as indicated. The wood used for repairs should, of course, be willow: if it is possible to cut up an old bat plenty of suitable material can be found.

In carrying out repairs such as those shown at Figs. 2 and 3, the notch or groove should be cut with an inward bevel. The new piece should be planed to fit, but it should be thicker than the groove is deep, so that it can be planed down evenly after the glue has dried.

The repairs shown at Figs. 4 and 5 are quite simple, and if the touching parts are planed to a close fit, well glued and then bound with whip-cord, the bat will be almost as good as new.

New cane handles are not beyond the skill of a boy who can use his tools. Although a handle can be built up with four lengths of wood, as at B, there is a considerable loss of flexibility. It is better to use a number of lengths of cane, starting with a square as at C, and building up the shape as at D. The wedge shaped slot in the blade of the bat should be cleaned smooth and the new handle tapered as at Fig. 8, to fit the space exactly. Fig. 9 illustrates the method of cramping up.

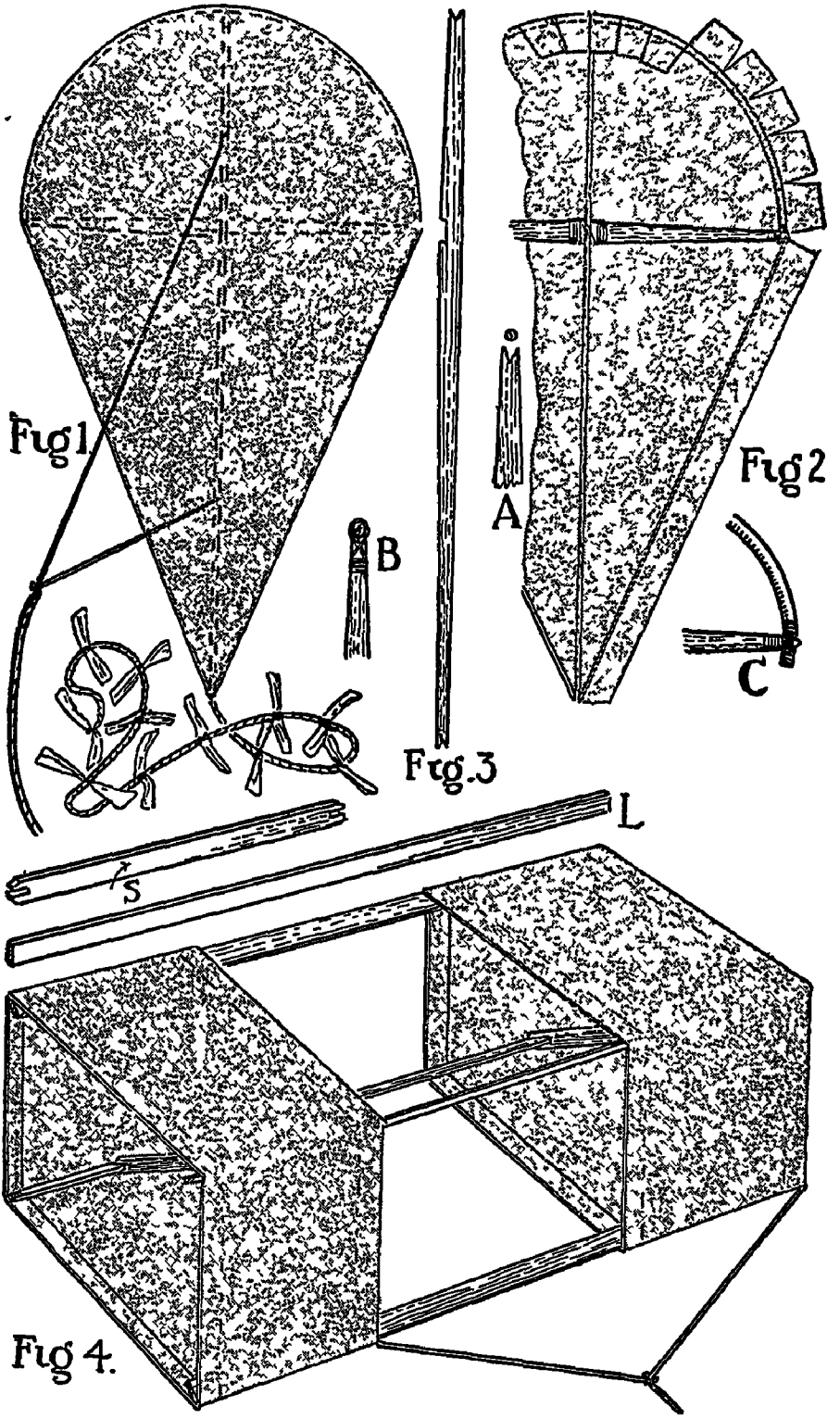
The method of wrapping the handle of a bat is shown at Fig. 11. The appliance required to hold the bat is easily made from 2 in. by 1 in. wood, as indicated at Fig. 12. The pivot at one end is a wire nail, at the other a screw-eye.


Fig 1
Fig 3
Fig 4
Fig 5
Fig 2
A
Fig 6
Fig 7
B
C
Fig 10
Fig 8
Fig 9
Fig 12
Fig 11

HOW TO MAKE KITES

One of the commonest and easiest kites to make is the ordinary peg-top pattern shown at Fig. 1. The backbone should be a stiff piece of wood, for a large kite it can be 3 ft. long and about twice as wide as it is thick, the latter dimensions depend on the kind of wood used; with ash, the size can be 1 in. by ½ in. at the thickest part. The bow should be of cane, ordinary rattan or split bamboo, the latter generally being the most serviceable. For backbone of 3 ft., the length of the cane for the bow should be 33 in. The bow string is tied to the backbone and to the ends of the bow, making a distance between of 21 in. The covering can be thin glazed calico or aeroplane silk, the sides are sewn or pasted to strings fastened to the ends of the bow and the bottom of the backbone. The box kite shown at Fig. 2 is formed with four 30 in. lengths, each $\frac{7}{16}$ in. by $\frac{3}{16}$ in. with outer edges rounded. The cross bars are ½ in. by ¼ in. The material is cut to 10 in. wide and each of the four sides are 15 in. long, the edges being folded over and pasted down with wire in the fold. The method of fitting the material is to make the two endless bands first, then fit on the frame, adjustments can be made to the centre cross bars in order to stretch the material to the full amount. The correct position of the strings is shown for both.

Another type of box kite is shown at Fig. 5 on page 115, it is pentagonal in shape and particularly effective. The method of construction is shown at Fig. 6, and to begin with prepare four tin centres, as at Fig. 7. The metal should be quite thin, the


Fig 1
B
Fig.3
A
Fig 2
C
L
S
Fig 4.

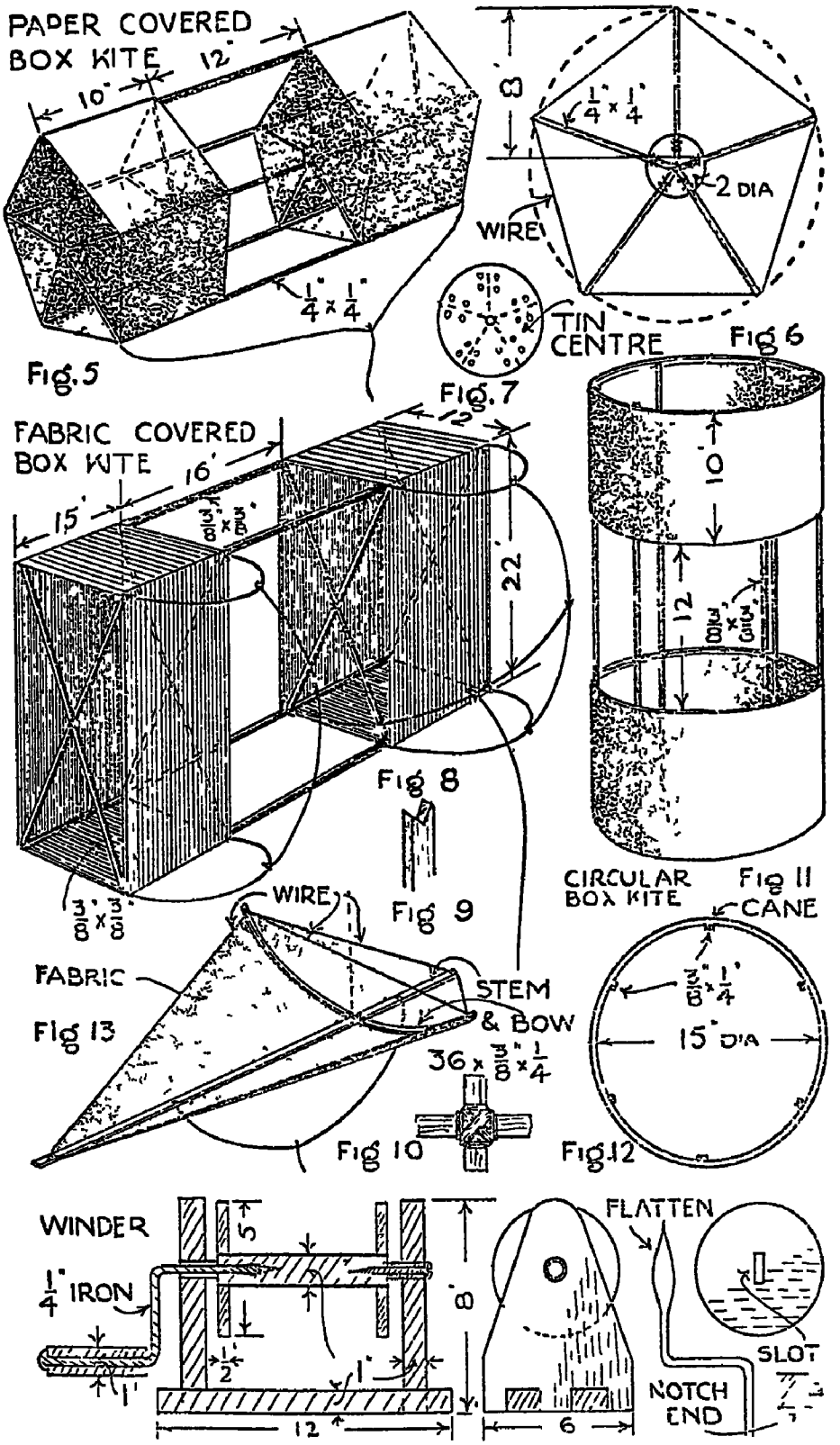
cuttings from air-tight tobacco tins will answer very well. For the ribs and sides use $\frac{1}{4}$ in. by $\frac{3}{4}$ in. spruce; for the outside of the ribs use fine wire and cover with manilla paper.

The fabric covered box kite, shown at Fig. 8, is made similarly to that at Fig. 4. This kite, if made to the dimensions given, should be covered with glazed linen or calico. The shape of the ends of the struts is shown at Fig. 9 and the method of joining them at Fig. 10.

The circular kite, shown at Fig. 11, is an interesting kite to make. The six long lengths are 2 ft. 8 in. by $\frac{3}{8}$ in., but with specially selected spruce, $\frac{1}{4}$ in. wood can be used. Four hoops are needed, these must be made from cane, with the joint spliced and bound. Cover the boxes with fabric.

Another interesting kite is shown at Fig. 13. It is, in many ways, similar to the bow kite, but the fabric covering is curved as shown, and is pasted over the wire edges which should be quite taut.

A convenient form of kite winder is shown at the bottom of the page. Prepare some 1 in. thick wood to form the base, which should measure 12 in. by 6 in. The two uprights are prepared to 8 in. by 6 in., shaped at the top and tenoned into the base. The drum should be 1 in. diameter with flanges 5 in. diameter and $\frac{1}{2}$ in. thick. Bush the holes in the upright with brass tubing and form the handle from $\frac{1}{4}$ in. diameter round iron. The end fitting into the drum should be flattened out as shown and a length of round fitted on the other end. The winder should be painted or varnished.


PAPER COVERED
BOX KITE
12"
10"
1/4 x 1/4
Fig. 5
8"
1/4 x 1/4
2 DIA
WIRE
TIN
CENTRE
Fig 6
Fig. 7
FABRIC COVERED
BOX KITE
16"
15"
3/8 x 3/8
12"
22"
3/8 x 3/8
Fig 8
Fig 9
WIRE
FABRIC
Fig 13
STEM
& BOW
36 x 3/8 x 1/4
Fig 10
10"
12"
3/8 x 3/8
CIRCULAR
BOX KITE
Fig 11
CANE
3/8 x 1/4
15" DIA
Fig 12
WINDER
1/4 IRON
5"
8"
1/2"
1"
1"
12"
6"
FLATTEN
SLOT
NOTCH
END

A STEERABLE TOBOGGAN

The design, shown in plan and side view at Figs. 1 and 2, is effective and not difficult to make.

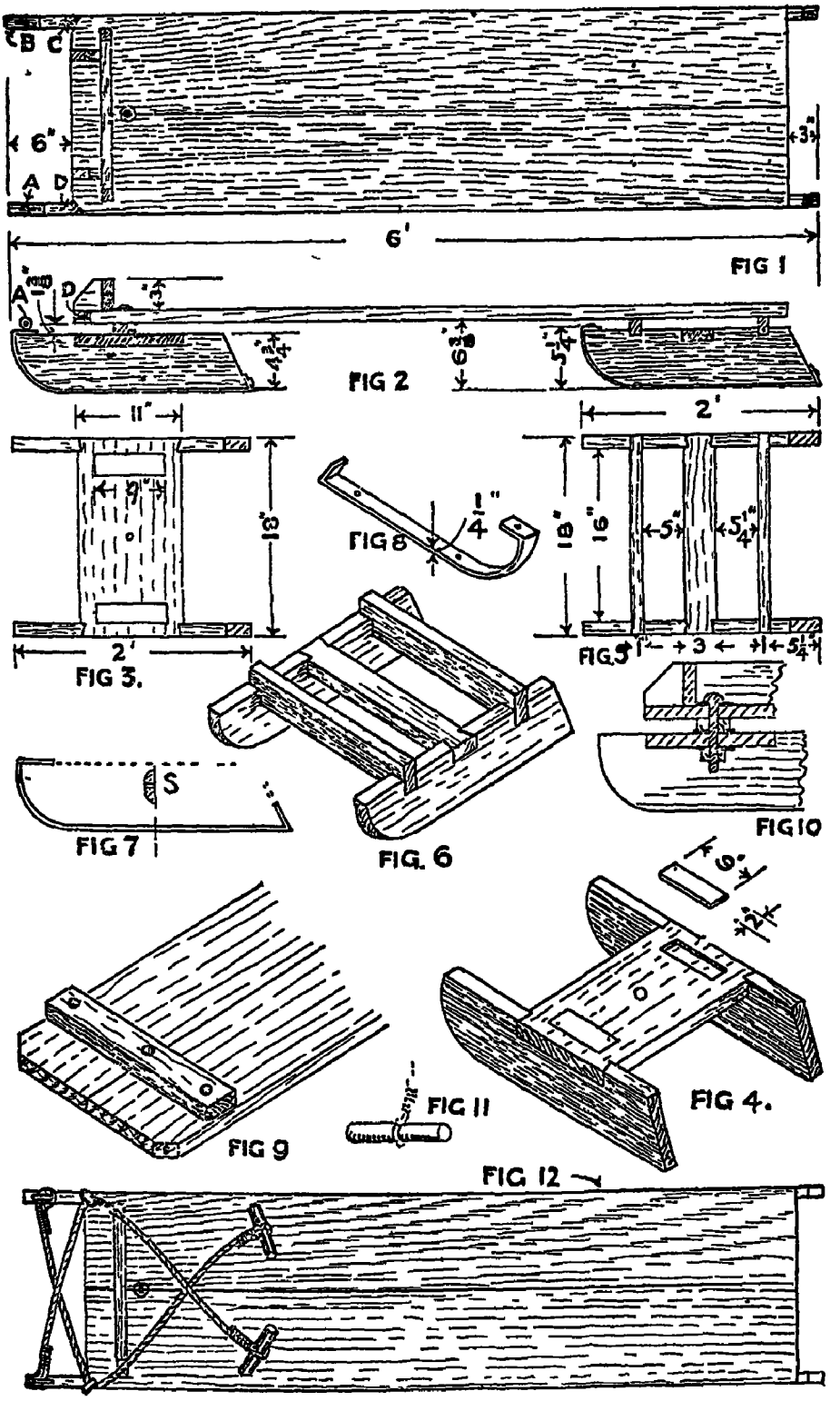
The front runner at Fig. 3 consists of two sides and one cross piece. The latter piece is secured to the side pieces with dovetail joints, metal plates being let in as indicated at Fig. 4.

The back runner, at Fig. 5, has sides made to the same shape as the front runners, but they are joined with three pieces, two being housed in and the centre one dovetailed as at Fig. 6.

All four side pieces are shod with iron made to the shape at Fig. 7, from either flat or half-round iron bar—it is better to get this done by a blacksmith; the finished shape is shown at Fig. 8.

The top board should be 1 in. finished to a length of 5 ft. 3 in. Two boards will be needed, planed down to a width of 9 in. At the fixed end, the board should be screwed down to the two projecting pieces on the back runner; in front, the boards are screwed down to a 2 in. by $1\frac{3}{8}$ in. piece, as shown at Fig. 9. Bore a hole in the middle and then drive in two domes of silence to rest on the metal plates in the movable runner. Fix the 3 in. by 1 in. piece with brackets on the top of the board in front as at Fig. 2. Attach the board to the runner with nut and bolt as at Fig. 10.

Four strong screw-eyes are driven in the front, two are fixed to the top of the runner as shown at A and B, the other two are driven into the front of the board as at C and D. The cord should be of best quality sash line. Two short lengths of 1 in. or $1\frac{1}{4}$ in. round wood should be provided for handles as at Fig. 11, fix as at Fig. 12.


B C
6"
A D
3"
6'
FIG 1
A
D
FIG 2
11"
13"
2'
FIG 3.
1/4"
FIG 8
2'
18"
16"
5"
5 1/4"
FIG 5
S
FIG 7
FIG. 6
FIG 10
FIG 11
FIG 4.
FIG 9
FIG 12

A TENT FOR CAMPING

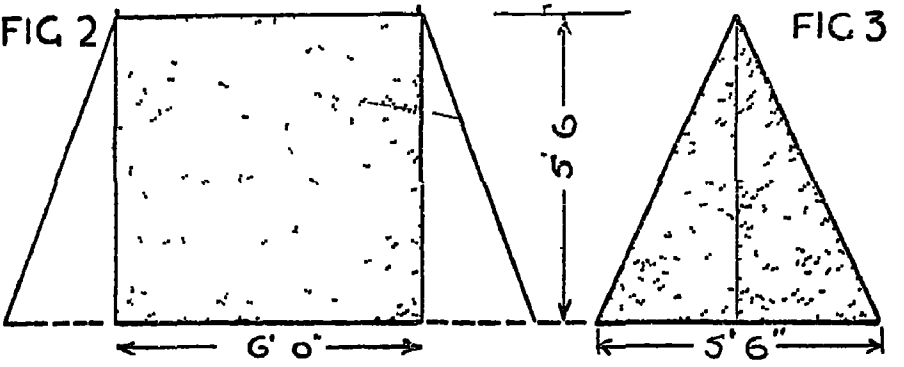
The tent at Fig. 1 is easily made and can be carried on a cycle. The plan and elevation at Figs. 2 and 3 give the main dimensions; the plan at Fig. 4 shows the method of placing the guy ropes.

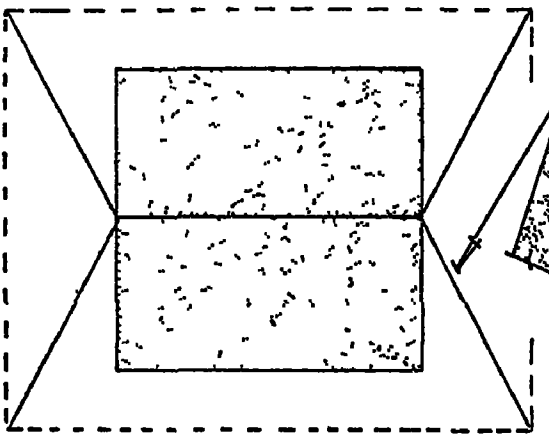
The two poles should measure 5 ft. 6 in. long and be 1¼ in. dia. They may be made in two lengths and joined by a brass ferrule. Both ends should be fitted with short lengths of brass tubing and long wire nails driven into the wood, the head of the nails being filed off and finished to a blunt point.

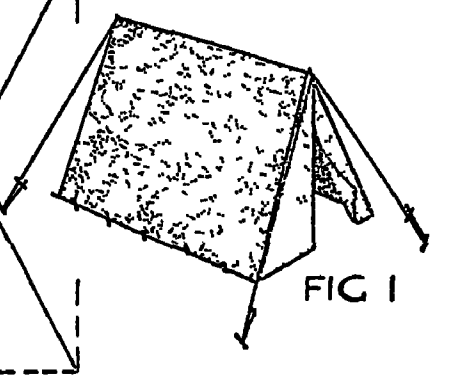
The guy ropes should be attached to thimbles as at Fig. 5; strong string must be bound on the rope to hold the thimble in place. The tent pegs, as at Fig. 6, should be of beech, four long pegs for the guy ropes and about eight for pegging the sides. Toggles, as at Fig. 7, will also be needed, they should be of beech and about 4 in. by 1 in. by ½ in.

The tent cloth, as at Fig. 9, can be of canvas or cotton; there are several inexpensive forms of light cotton. If the material can be obtained full width it will save a centre join. The end hems are 4 in. wide; the flaps are cut out separately and joined on, the outside edges having 2 in. hems.

Eyelet holes should be made at the corners of the ridge, along the bottom and on the flaps as at Fig. 10. Metal eyelets can be purchased, but it will do if the holes are cut out and bound with linen thread. Instead of eyelets, tapes may be used on the bottom edges and flaps, or cord loops can be attached to the bottom edges of the tent for the pegs, and long loops can be fitted to the flaps.


FIG 2
5' 6"
6' 0"
FIG 3
5' 6"


FIG 4


FIG 1

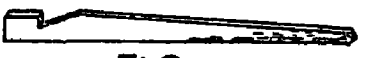
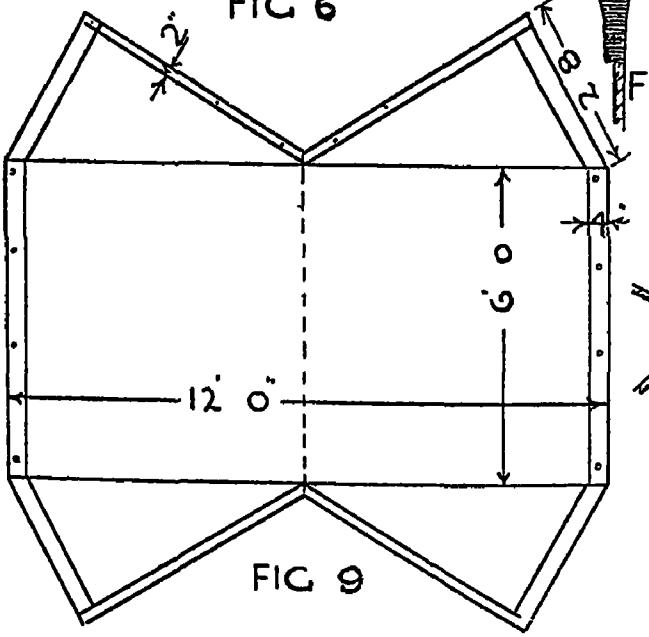
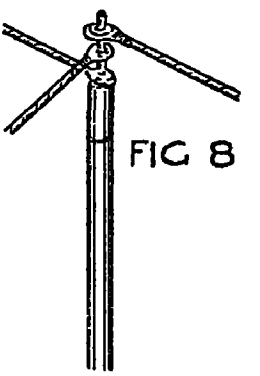

FIG 6


FIG 5


FIG 10


FIG 7


2"
8"
6' 0"
12' 0"
FIG 9


FIG 8

CAMP BED AND HAMMOCK

The camp bed, shown at Fig. 1, is suitable for use with a tent. The dimensions are given in the side and end views, and the plan at Figs. 2, 3 and 4. On soft ground the legs will hold the bed firmly, but if the extra weight does not matter, it would add to the strength if the legs were joined at the bottom with strips of wood screwed on in the position shown by the dotted lines at A in Fig. 2.

The wood for the bed should be cut from 2½ in. by 1½ in. material. The two pieces for the legs are joined with bolts and wing-nuts, but they may be hinged together with a screw so as to fold up.

The method of attaching the long rails, as shown at Fig. 5, is carried out by notching the top of the leg pieces, as at Fig. 6, and then securing with a bolt and wing-nut as at Fig. 7. The canvas should be tacked to the inner side of the rails.

As an alternative to a camp bed, the canvas hammock, shown at Fig. 8, is useful. With a tent provided with strong poles, the hammock can be slung on hooks attached to the poles, or if used in the open, to convenient trees or posts.

The two end pieces, as shown at Fig. 10, should be made from oak, birch or beech, cut to the sizes given. Deal can be used for the purpose, but it should be at least 2½ in. wide and 1½ in. thick. Four holes are bored at each end for the supporting lengths of rope. The holes should be about 2½ in. apart and about 2 in. from the ends. The canvas should be one yard wide. Secure the canvas to the inside edges of the end pieces with clout nails, and thread the rope through the holes and the rings.

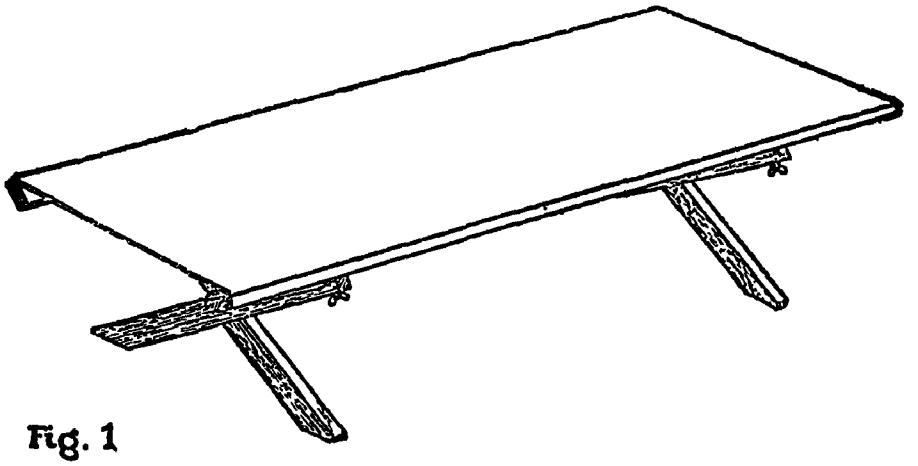


Fig. 1

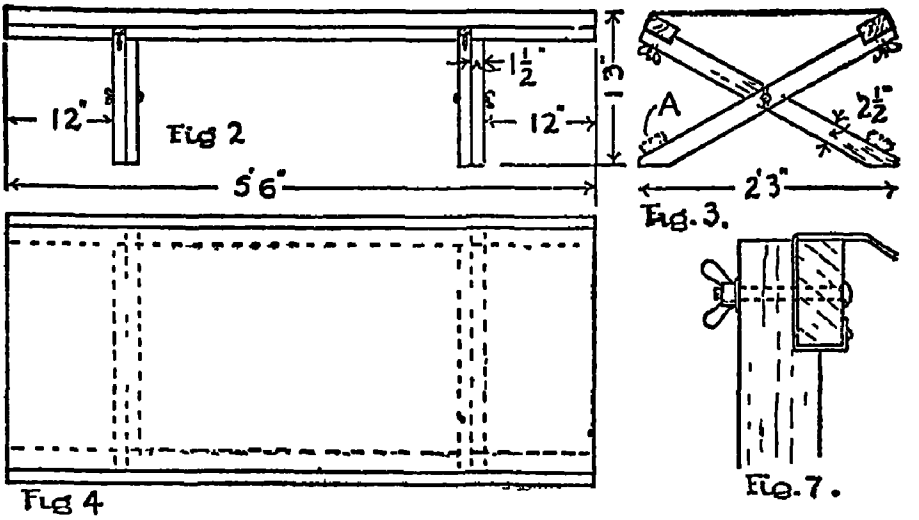
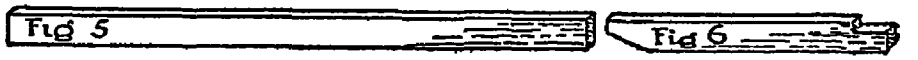


Fig. 3.

Fig 4

Fig. 7.



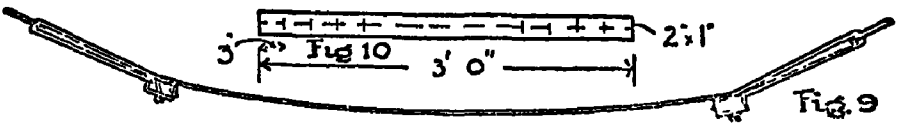


Fig. 9

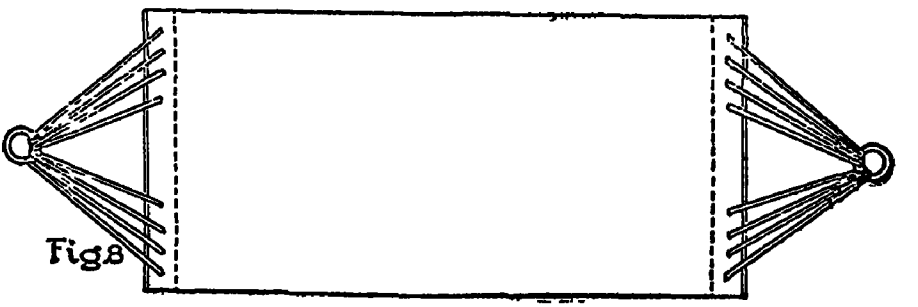


Fig 8

A SCRAPER MAT

The mat shown at Fig. 1 is easily made from yellow deal batten or other lumber measuring 2 in. wide and $1\frac{1}{4}$ in. thick. The bars are made from old bed battens or any available thin iron strips.

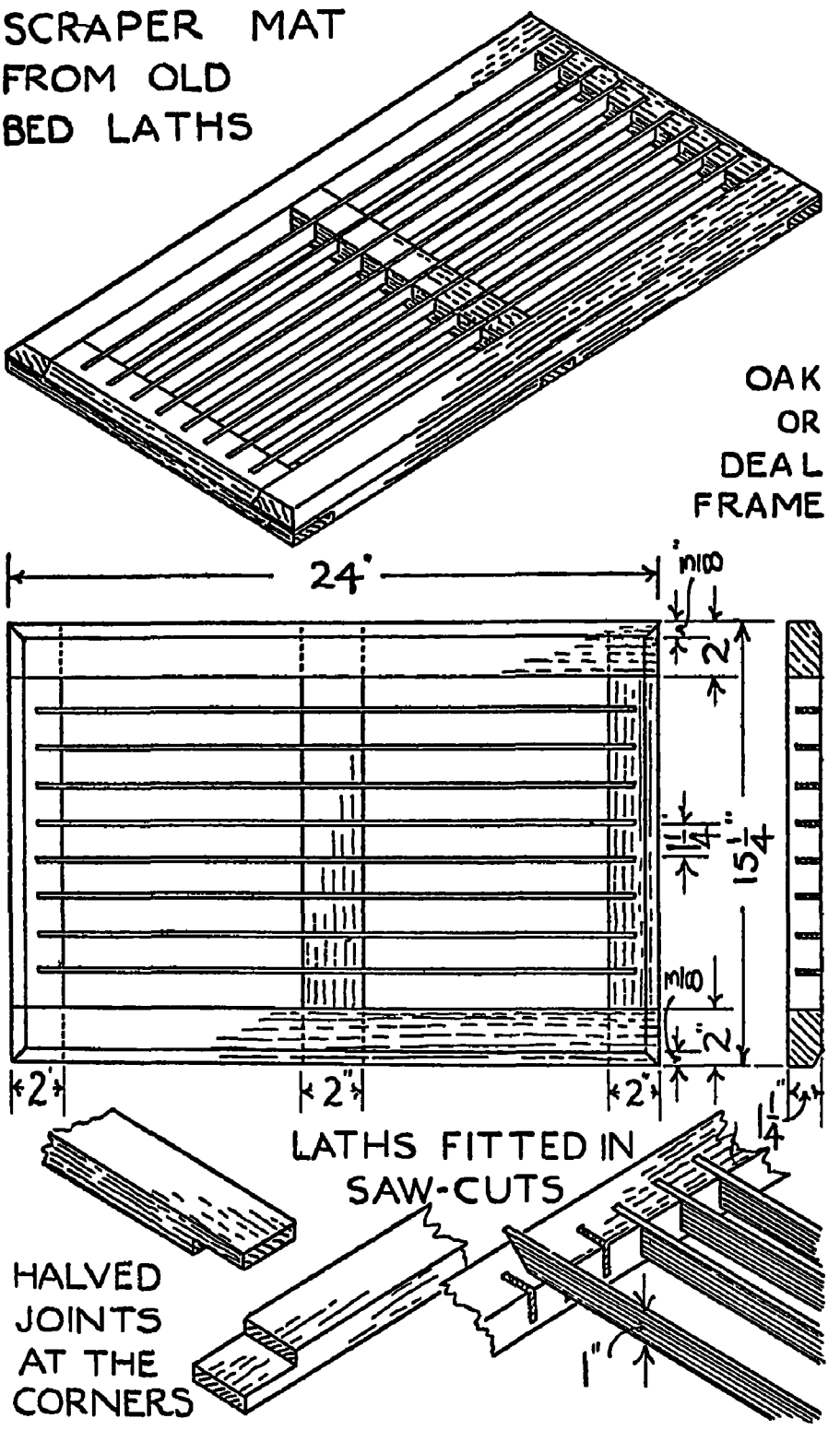
The wood should be finished to 2 in. by $1\frac{1}{4}$ in., unplaned wood should be large enough to allow for planing. If it is possible to obtain some oak, it should be used in preference to deal as then the mat will wear much longer.

The two side pieces should be cut to 24 in. long and three cross pieces prepared to a length of $15\frac{1}{4}$ in. The sizes are given because they make a mat of convenient size for any doorway. There is no reason why a special size of mat should not be made to suit a particular door.

The corners of the frame are joined by means of the lapped halving joint as shown. The same joint is used for the centre bar. The camfer on the outside should be planed down $\frac{3}{8}$ in. each way after the joints have been glued up.

The bars as shown in the separate detail are fitted in saw cuts made across the corners of the end pieces and right across the centre bar. The ends of the lengths are filed off to a mitre angle to fit into the saw cuts.

This part of the work should be done with some care so that the bars fit exactly into the sawn slots. If the material should be wider than the width of the saw available, it would be better to mark off the spaces with cut lines carried into the wood as deeply as possible. In this case it will be possible to make two thin saw cuts, and if necessary cut away the waste with a thin chisel.


SCRAPER MAT
FROM OLD
BED LATHS
OAK
OR
DEAL
FRAME
24"
2"
2"
15¼"
2"
2"
2"
2"
1¼"
LATHS FITTED IN
SAW-CUTS
HALVED
JOINTS
AT THE
CORNERS
1"

A CHEMICAL WEATHER GLASS

Although a chemical weather glass is not so reliable as the more expensive barometer, it does indicate weather changes. When the liquid is clear, it is likely that it will be fine and dry, when small crystals form and gradually rise up the glass, it is an indication that changes are at hand and when fern-like formations are seen at the tube top, it may be cold and stormy.

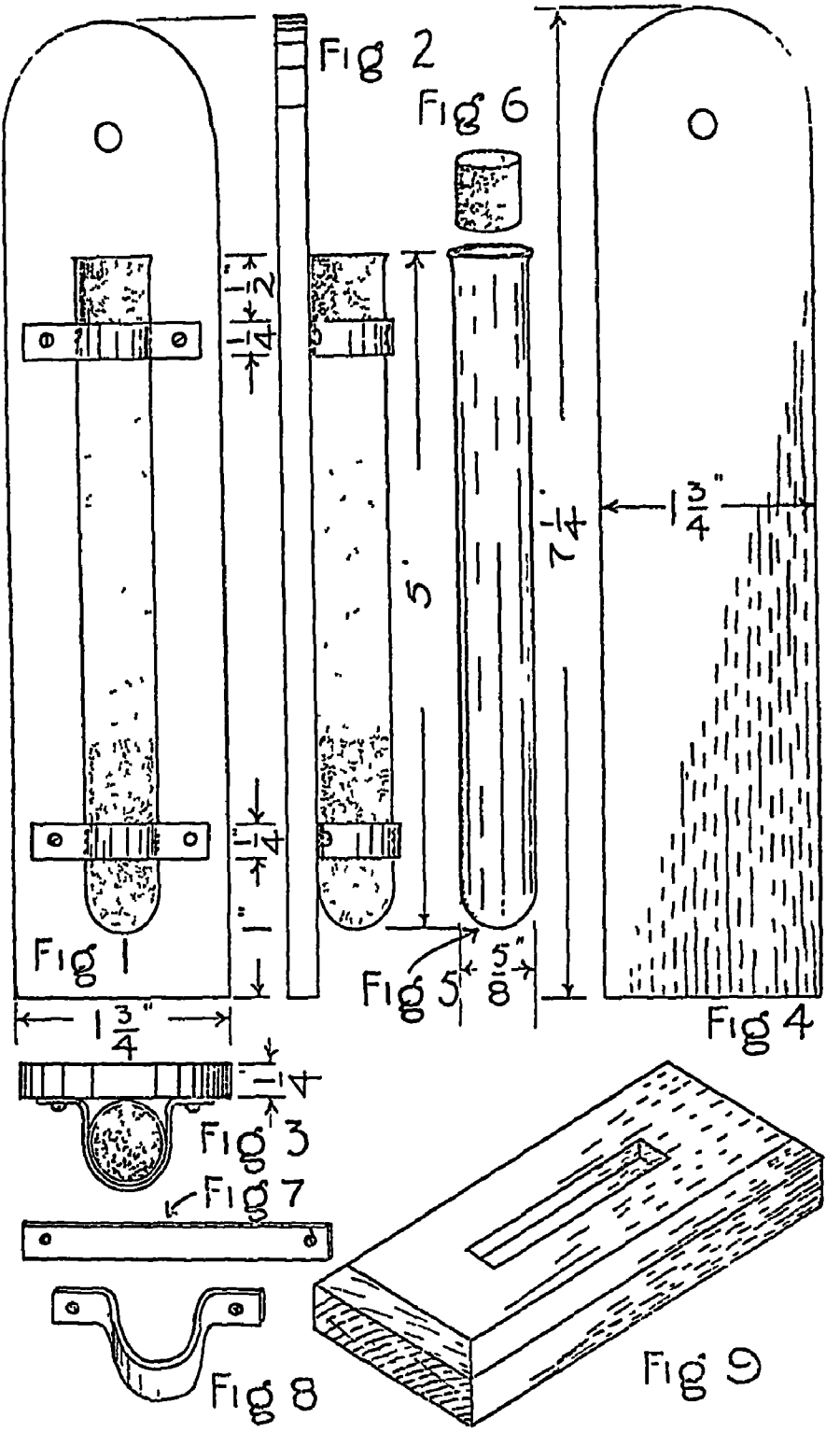
The apparatus is quite simple to make and consists of a $\frac{5}{8}$ in. diameter, 5 in. or 6 in. test tube, fastened to a wooden support with brass strips.

Prepare the back piece, as at Figs. 1, 2 and 3, to $7\frac{1}{4}$ in. by $1\frac{3}{4}$ in. by $\frac{1}{4}$ in. Curve the top with a radius of $\frac{7}{8}$ in., pare neatly, and finish with glass-paper.

Fit the tube with a cork, as at Figs. 5 and 6, and prepare two strips of thin brass, as at Fig. 7, cutting them $2\frac{1}{2}$ in. long and $\frac{1}{4}$ in. wide. Drill holes for the fixing screws at the ends and bend them to the required curve as at Fig. 8.

The upright, as shown at Fig. 4, can be fitted in a stand made as indicated at Fig. 9, using a piece of wood about 5 in. by 2 in. by $\frac{1}{2}$ in. Make the slot about $\frac{1}{4}$ in. deep to the section of the upright and fix by screws from underneath. Finish with polish or shellac varnish.

Fill the tube with the following solution: Camphor, 1 dr., Potassium Nitrate, $\frac{1}{4}$ dr., Ammonium Chloride, $\frac{1}{4}$ dr., Absolute Alcohol, 1 oz., and Distilled water, 1 oz. Mix in a beaker, place in a bowl of hot water and stir until dissolved. Pour into the tube and insert the cork, which should be sealed with sealing wax.


Fig 2
Fig 6
1 1/2"
1 1/4"
1 1/4"
1"
5"
7 1/4"
1 3/4"
Fig 1
Fig 5
5/8"
Fig 4
1 3/4"
1 1/4"
Fig 3
Fig 7
Fig 8
Fig 9

A BLOTTING PAD

The blotting pad illustrated at Fig. 1 consists of a thick cardboard, millboard or plywood base with corner pieces of metal, copper or brass of 18 gauge or pewter of 14 gauge; the thickness is measured by S.W.G. The four metal plates are $3\frac{3}{8}$ in. square, but they can be set out on a piece measuring $6\frac{7}{8}$ in. square. The method of marking one of the plates is shown at Fig. 2, lines $2\frac{1}{2}$ in. and $2\frac{7}{8}$ in. being marked off from adjacent sides with the diagonal lines as shown. The pierced openings shown at Fig. 3 are set out from circles and then drawn by hand. The openings can be sawn out with a fretsaw or a series of small holes can be cut and finished with a file. The method of bending the edges of the plates is shown at Fig. 4, the first stage being done on a hardwood block with a mallet. For the second stage, as at Fig. 5, a metal plate equalling in thickness the base, plus sufficient for the blotting paper, should be provided, but a piece of hardwood can be used instead, although it will be rather difficult to obtain sharp edges. The plates should be given another polish and if copper or brass are used they should be warmed and then coated with colourless lacquer which can be bought at most oil and colour shops; it is applied with a camel hair brush. Keep the metal free from finger marks and not too hot to hold on the hand. The plates shown at Fig. 6 should be placed in position on the prepared base, the size at Fig. 1 is for a full size piece of blotting paper, and holes should be bored so that paper fasteners can be pushed through and turned over on the top.

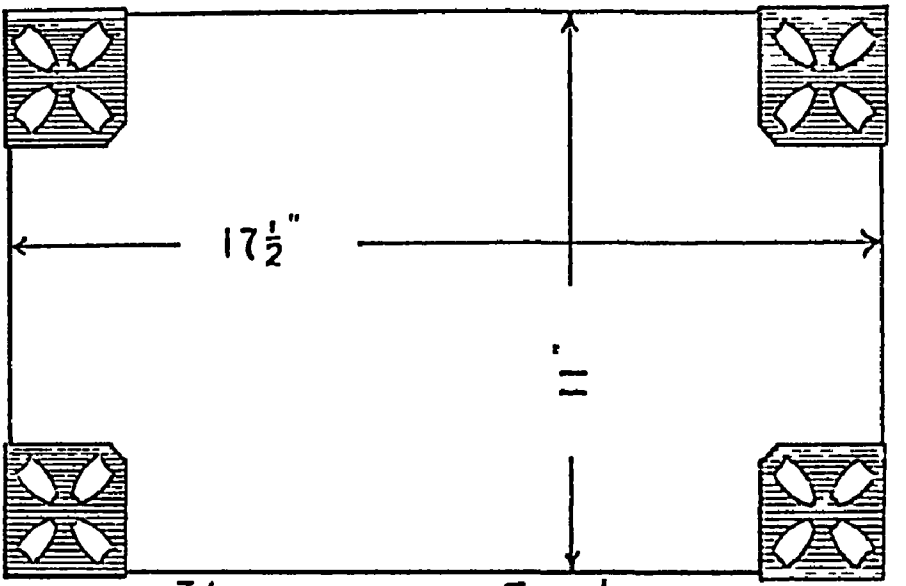


Fig. 1

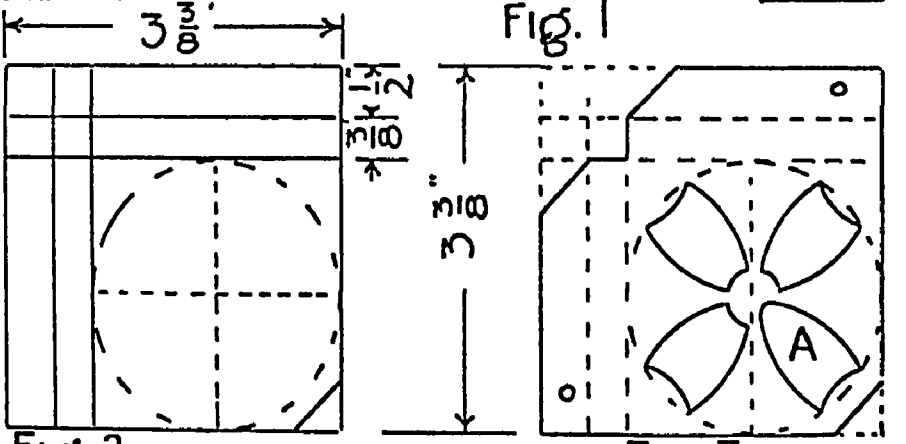


Fig 2

Fig. 3

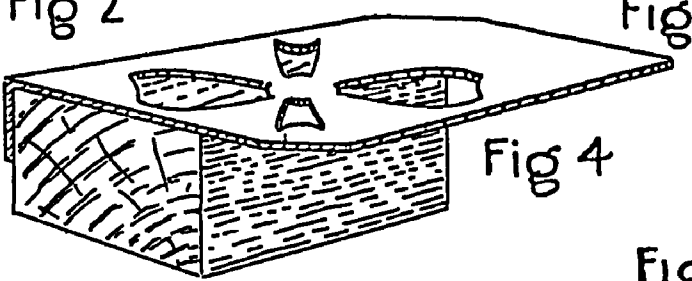


Fig 4



Fig 5

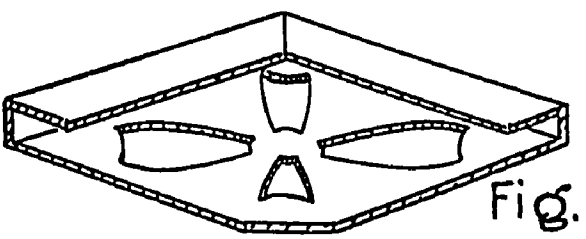


Fig. 6

AN ICE-CREAM FREEZER

The ice-cream freezer at Fig. 1 will appeal to many readers. It will be seen by the section at Fig. 2 that two lever-lid tins are required, one is of a large size and the other a few inches shorter and less in diameter. Those used by the writer were 10 in. deep and 6 in. diameter for the outer case and 8½ in. by 3¼ in. for the inner case.

The first thing to do is to clean them thoroughly. Next mark off the diameter of the smaller tin on the bottom of the larger one and proceed to cut a hole right through the bottom. This will probably be found the most difficult portion of the work. A small pair of tinman's shears or the scissor form of tin opener can be used. The inner tin is now soldered in position, and to ensure that the inner case is parallel to the sides of the outer case, small blocks of wood should be placed inside to keep it in position during soldering. The handle and pin are made of galvanised wire soldered to a boss. The base should be of ¾ in. wood with two slotted uprights, tenoned in as shown. In the section at Fig. 2, A is the outer tin; B, the lever lid. C is the bottom of the outer tin to which the inner tin, D, is soldered. E is the lever lid of the inner tin. F is the spindle solder to B, and G shows the boss used also to support the handle at H. Fig. 3 shows the lid at E, with the handle in position and at Fig. 4 is a suggestion for a shaped handle. The support is shown separately at Fig. 5. The cream should be placed in the inner compartment and the freezing mixture in the outer and the latter revolved. Always wash out and thoroughly dry the tins after use.

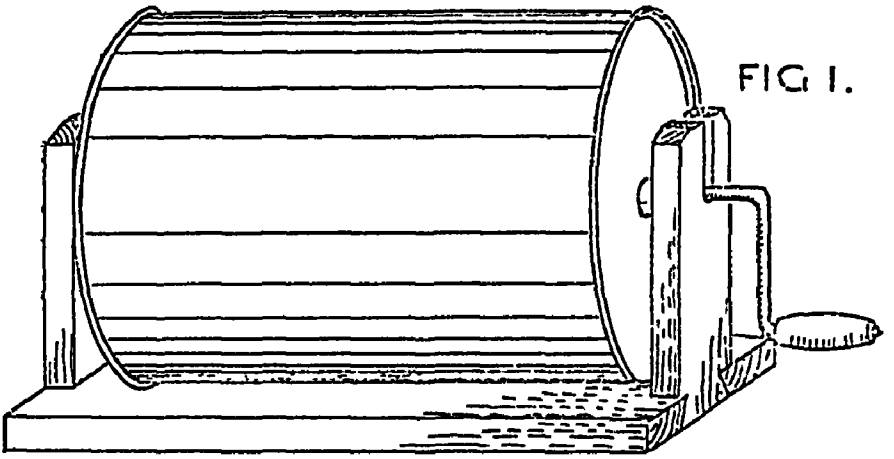


FIG 1.

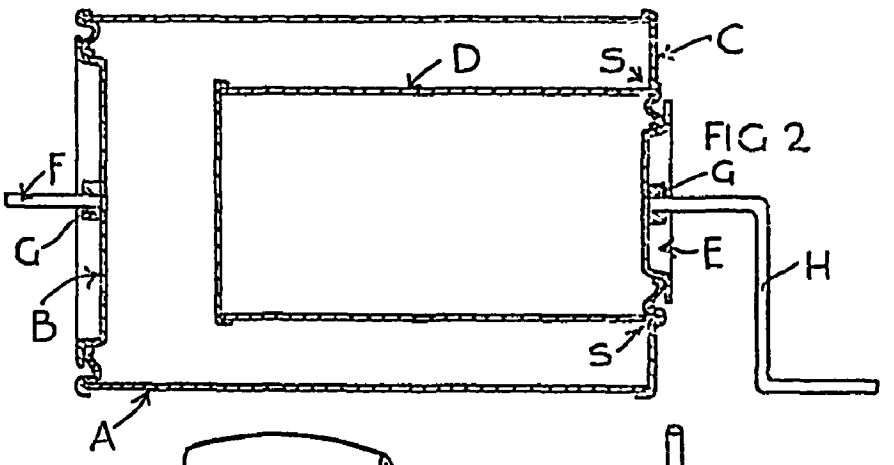


FIG 2



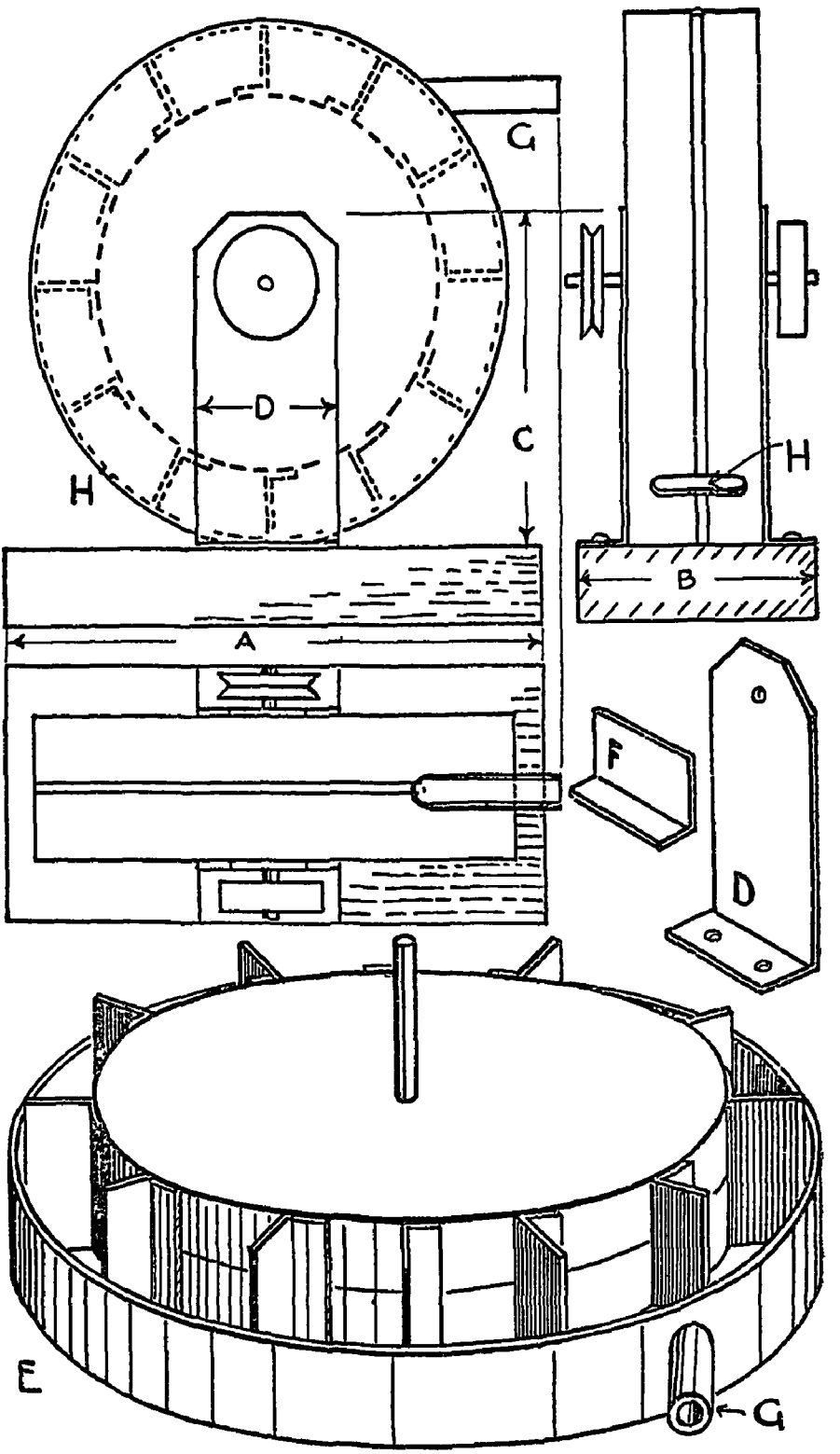
FIG 4

FIG 3

FIG 5

A STEAM TURBINE MOTOR

The turbine shown in section, end view and plan at Figs. 1, 2 and 3 can be made from a large and a small boot polish tin and a few scraps of wood and metal. First clean the two tins and cut out pieces of paper to the exact size of the inside of each. Place the papers inside the tins and lids and mark the centres with a centre punch. Provide a 4 in. wire nail which will act as a spindle and find a drill of the same diameter with which to drill holes. Next fit the spindle and place the smaller tin inside the larger and measure the distance between the outer circumference of the smaller to the inside of the larger. The blades should be slightly shorter than the distance between the two tins, and as many as can be conveniently fitted should be soldered to the inner tin. The blades should have a flange shown at F. Allowance must be made for a thin washer on each side of the inner tin and the blades must revolve easily. E shows the inner tin fitted with blades in position. Next fit a short length of tube about 1 in. long and $\frac{1}{8}$ in. diameter as at G and solder it in. Copper tube can be bought, but a short length can be easily made from a scrap of tinned sheet folded over a wire nail and soldered. A hole about $\frac{1}{8}$ in. wide is cut out of the larger tin on the edge at H. The outer tin after being sealed with solder round the joint is supported on two uprights, shown separately at D, they should be attached with solder and about 1 in. wide. The base can be any convenient size. The two pulleys can be of sheet brass or cast in lead, and soldered to the spindle. A diameter of $\frac{3}{4}$ in. to 1 in. will be sufficient.


G
D
C
H
H
B
A
F
D
E
G

A MODEL STEAM BOILER

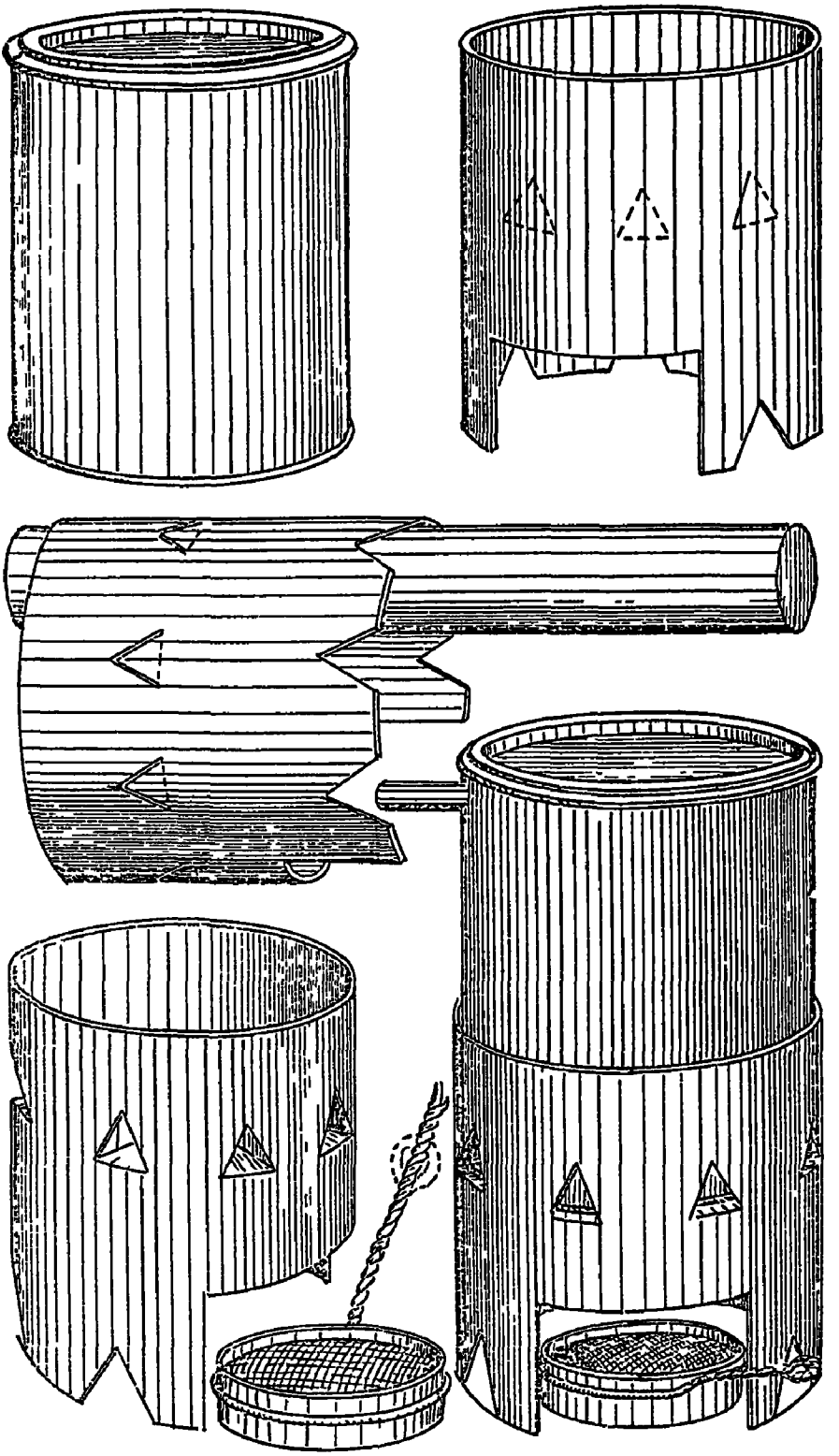
The first thing to obtain is a lever-lid tin similar to those used for golden syrup: one is likely to be found in every house. As this tin has to fit into another one slightly larger, there may be a little difficulty, but as only the sides of the tin are needed, any canister at all near in diameter can be used, or a piece of tinned sheet can be shaped to fit and soldered up.

Cut out the outer tin to the shape shown at B and, about halfway up the sides, cut a number of V-shaped openings as indicated by the dotted lines. This can be done with a sharp cold chisel on a hardwood round as shown at C. Complete the outer case by bending the cuts inward to form ledges to carry the boiler as at D and E.

The next job is to solder a short length of brass tube to the top of the boiler as shown at F, failing the ready prepared tubing, a piece of tinned sheet may be bent round a large wire nail and soldered up. The tube should project at least 1 in. on the outside and $\frac{1}{8}$ in. on the inside so that a good soldered joint can be made.

The lamp can be made from the lid of a small blacking tin or one of suitable size. Bend a length of stout wire around the tin and twist up to form a handle as indicated at G.

Provide a piece of fine wire gauze to fit inside the lid, place some cotton wool underneath and then the lamp is ready for use. To start the boiler, fill about two-thirds with hot water, fix the lid on firmly, pour some methylated spirit into the lamp and when alight place under the boiler. Connect to the turbine with rubber tubing.



AN ASH TRAY IN BRASS OR COPPER

Any thin sheet brass or copper can be used in making this ash tray. A useful thickness would be No. 20 S.W.G. The tray may be made square with metal from 4 in. by 4 in., up to 6 in. by 6 in.

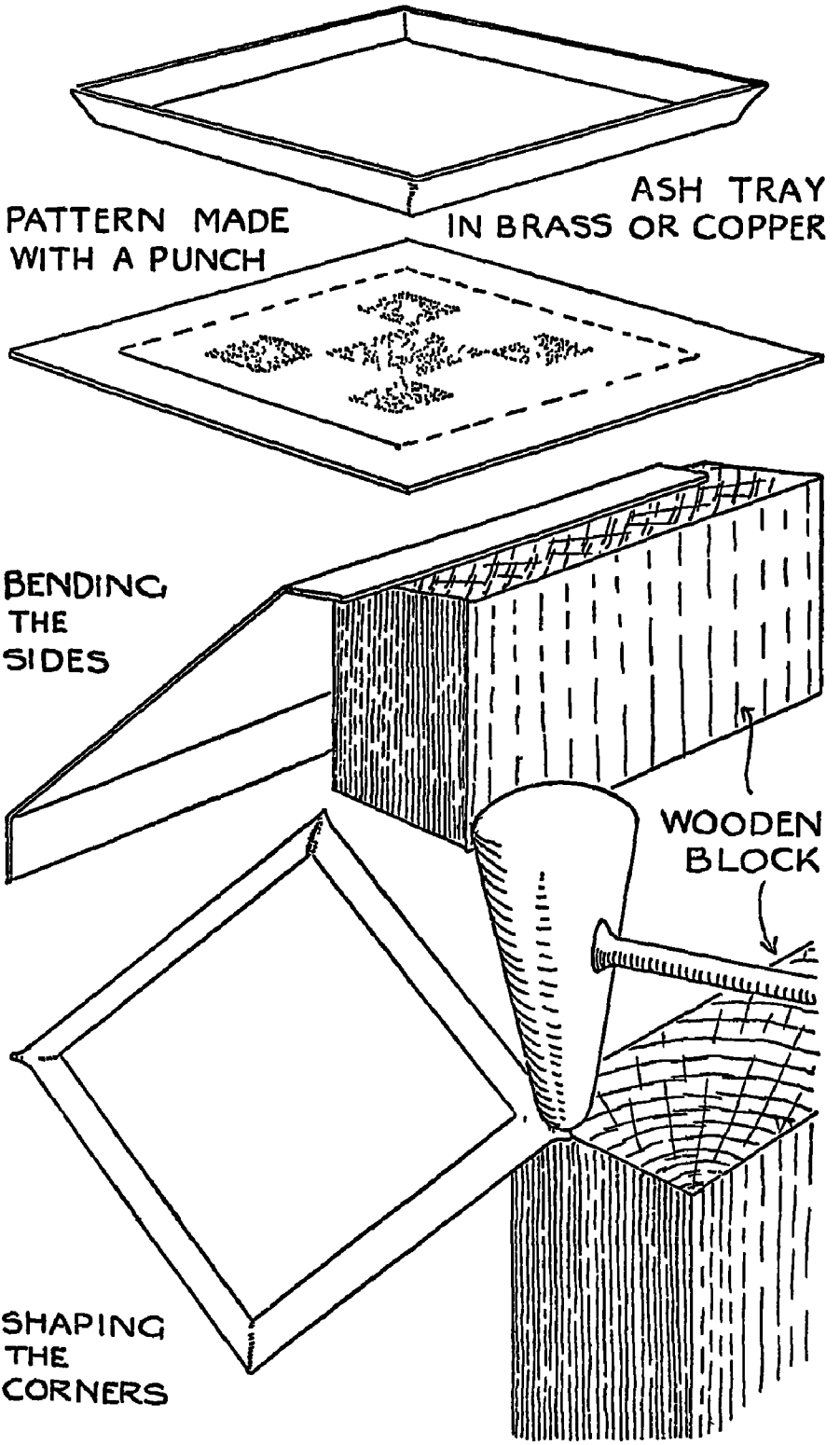
First clean up the piece of metal, this should be cut true with all angles right angles. Some sort of pattern should be worked on the surface, the suggestion given is easily done with a wire nail as a punch and a hammer. The small squares shown in the diagram are quite effective.

When the pattern has been punched, the surface of the metal should be cleaned with pumice powder applied with a stiff brush; cheap nail brushes are quite good enough for the purpose.

The edges are now bent over with a mallet, using the edge of a block of hardwood as shown in the diagram. Care should be taken to use the mallet lightly; this applies specially to a hammer if it is used instead of a wooden mallet. If the metal is hammered too hard, it is liable to spread and so cause a buckle; this will be found very difficult to remove.

The method of dealing with the corners of the tray is shown at the bottom of the next page. Use the corner of the block and tap first one side and then the other until a satisfactory shape is worked. This job will take a little time and should be done as carefully as possible.

Give the work a final polish with pumice powder and wipe it off without touching the surface with the fingers. Warm the tray by the fire or in an oven, but do not get it very hot, then coat with colourless lacquer using a soft or camel hair brush.


ASH TRAY
IN BRASS OR COPPER
PATTERN MADE
WITH A PUNCH
BENDING
THE
SIDES
WOODEN
BLOCK
SHAPING
THE
CORNERS

A MATCHBOX HOLDER AND ASH TRAY

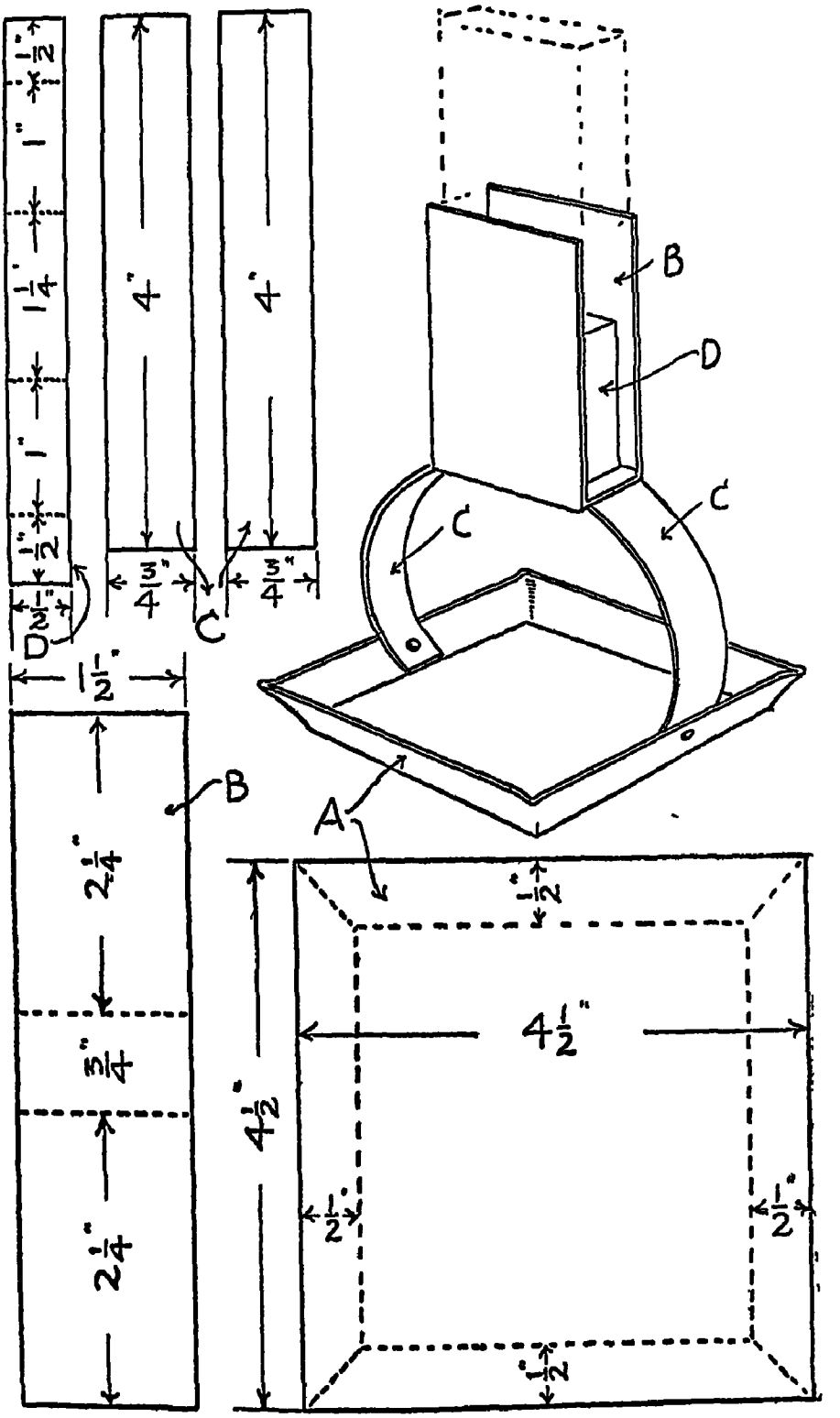
The useful piece of simple metalwork shown on the next page is something to follow the ash tray on page 135. It can be made from copper or brass, using thin metal about No. 20, S.W.G.

The method of making the tray has already been explained and the same process is followed. In this case the metal should be cut to a side of $4\frac{1}{2}$ in., giving a flat portion $3\frac{1}{2}$ in. square.

Prepare a piece of the same metal to $5\frac{1}{4}$ in. by $1\frac{1}{2}$ in., as indicated at B, this forms the case for the matchbox. Mark off lines $2\frac{1}{4}$ in. from each end to leave $\frac{1}{4}$ in. in the middle, then bend the two end portions upright and at right angles to the base. This can be done on a hardwood block.

Now prepare two strips as at C, each about $4\frac{1}{2}$ in. long and $\frac{3}{4}$ in. wide. These strips are now hammered to a curve, using a hardwood round or a short length of tubing. Light taps with the hammer on the round stake will bend the strips.

Now prepare a strip D to the measurements shown in the diagram and bend it to fit inside the holder at B. The next job is to drill holes for rivets. Two holes will be needed to attach together the top of the curved pieces C to the bottom of the holder B, together with the support at D. It will make the riveting easier to use split rivets. Drill the holes to fit the rivets, place them in position from the inside of the piece D, fit a block of wood inside the space formed by the bent sides of the piece D, and then push through the bottom of the holder B, and the ends of the curved pieces C. Close over the rivets and then attach the C pieces to the sides of the tray with ordinary rivets.


1/2"
1"
1 1/4"
1"
1/2"
1/2"
D
4"
4"
3/4"
3/4"
C
1 1/2"
B
2 1/4"
3 1/4"
2 1/4"
B
D
C
C
A
1/2"
4 1/2"
4 1/2"
1/2"
1/2"
1/2"

SERVIETTE RINGS IN PEWTER

Pewter is, for many reasons, an ideal metal for the beginner in metalwork. It is easily shaped, it can be sawn and easily pierced. It is not suitable for soldering, but as joins can be made by rivetting, such articles as serviette rings offer no difficulty.

A simple band is a matter of bending, drilling and rivetting, but with very little work the band can be decorated by a pierced pattern with the use of a fretsaw. Strips of pewter can be shaped as shown to an hexagonal, or any desired shape.

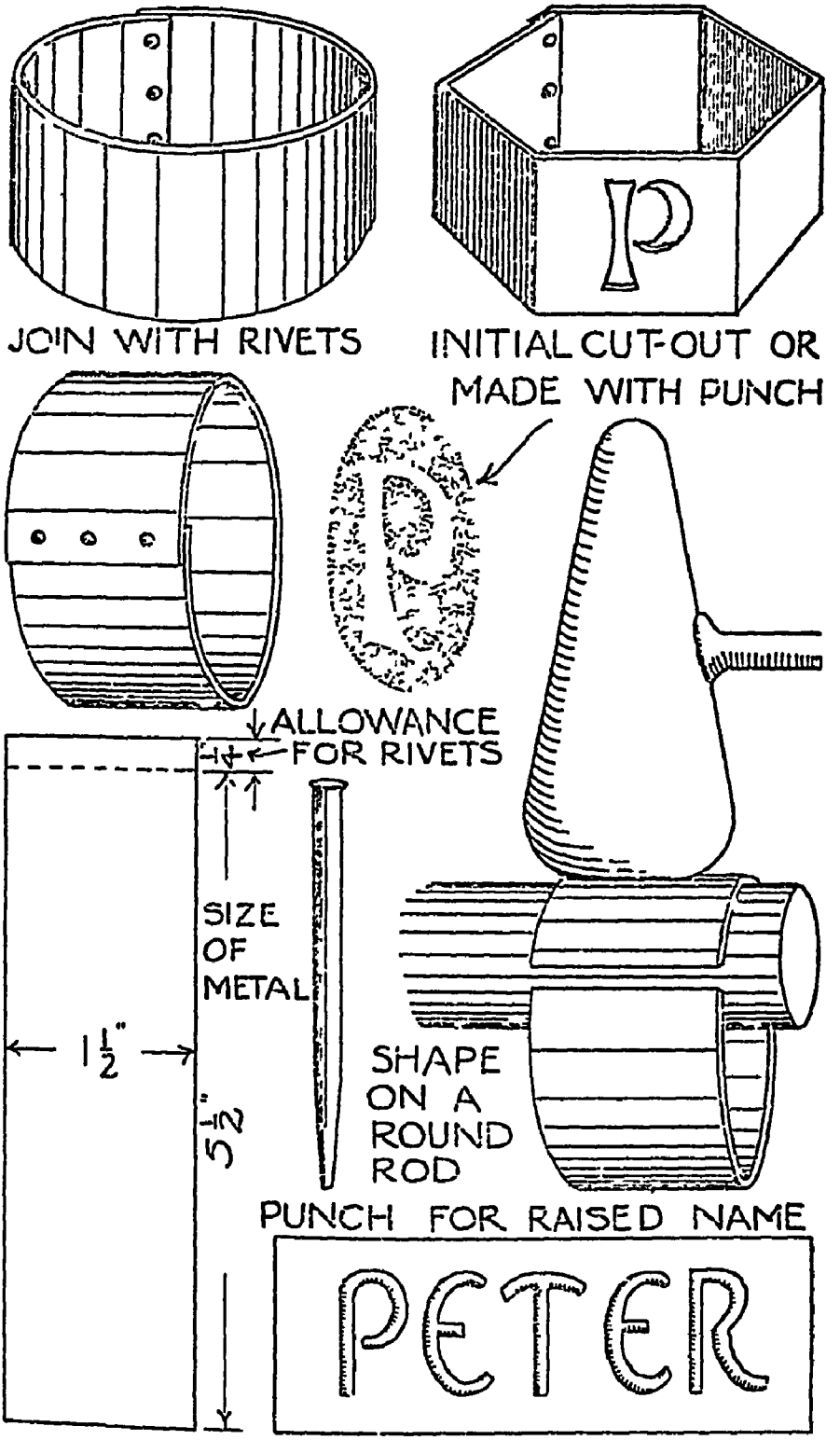
To make either of the shapes given in the diagram, cut out a piece of pewter $5\frac{3}{4}$ in. long and $1\frac{1}{2}$ in. wide. The thickness of the metal may range from No. 10 to No. 20, S.W.G., but it would be more satisfactory to use the thicker metal.

Shaping can be done on a wooden stake with a mallet, rounds being shaped on a round stake, hexagons and octagons on a flat and narrow stake, made either of wood or metal.

Initials and monograms can be worked either by punch marks, or, by means of a round punch, they can be raised from the surface.

In raising letters, a good form of lettering is shown in the word PETER. A simple way to carry out the work is to trace the letter or letters on tracing paper and reverse the paper, place a piece of carbon paper underneath and trace.

The metal is placed on some cork lino or sheet lead, and the punch is gradually carried over the shapes. The indentions should be slight at first, for it is better to work the hollows gradually thàn to attempt to work quickly. Pewter can be finished by polishing with pumice powder.


JOIN WITH RIVETS
INITIAL CUT-OUT OR MADE WITH PUNCH
ALLOWANCE FOR RIVETS
SIZE OF METAL
1½"
5½"
SHAPE ON A ROUND ROD
PUNCH FOR RAISED NAME
PETER

A NUT BOWL

The nut bowl shown on the next page is a piece of decorative metalwork not beyond the skill of any boy who has had a little experience in metal-working. The bowl can be made equally well in pewter, copper or brass.

Some size should be determined on first, for example a circle of 6 in. diameter can be cut from a piece of No. 20 gauge copper. It is necessary to provide a leather sand bag or a block of wood, with a carved or turned hollow, as shown.

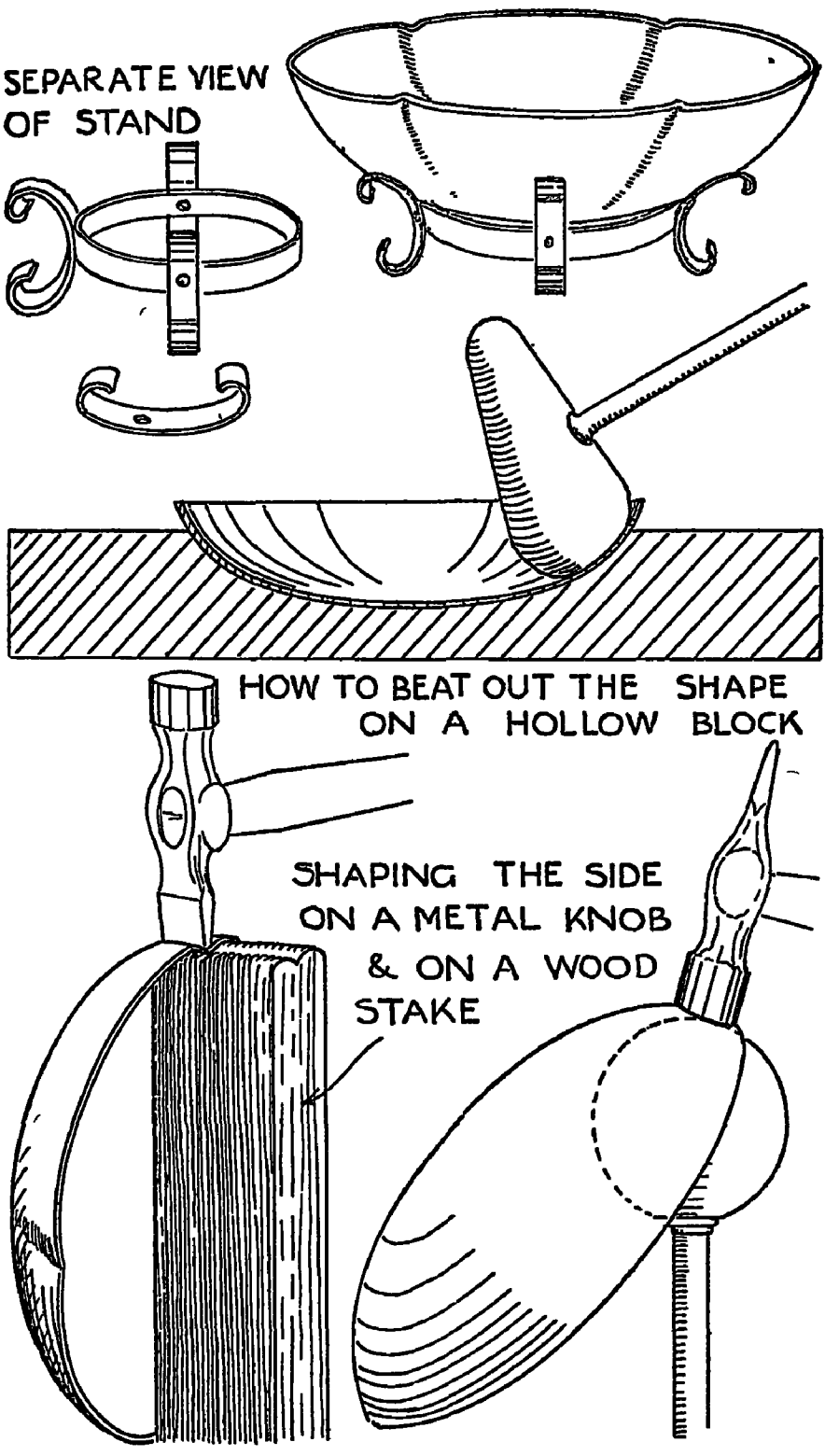
The metal should be beaten out in concentric circles starting from the centre and working outwards. After being beaten out once, the plate should be annealed or softened by bringing it to a red heat and allowing it to cool. Frequent annealing is essential.

When a pleasing shape has been roughly formed on the bag or in the hollow block, the shape should be trued up with a hammer as shown, working on a round stake; for this purpose a poker handle is useful.

The edges can be shaped with a hammer, as indicated, on a piece of wood, but the remarks about annealing should be kept in mind.

The stand, as shown separately, can be made from the metal as used for the bowl, but strip iron looks very well. The shaped legs are rivetted to a band which should fit under the bowl.

The bowl should be polished thoroughly with pumice powder and a pleasing finish can be imparted by planishing. This is done by covering the outside surface of the bowl with light hammer marks. When finished the work can be lacquered.


SEPARATE VIEW
OF STAND
HOW TO BEAT OUT THE SHAPE
ON A HOLLOW BLOCK
SHAPING THE SIDE
ON A METAL KNOB
& ON A WOOD
STAKE

A GARDEN TROWEL

The trowel consists of a piece of thin sheet steel or iron, a length of $\frac{1}{4}$ in. diameter iron rod, a short piece of broom handle, a portion from a brass tube and a couple of rivets.

Begin by cutting the sheet of steel or iron to the shape shown at Fig. 2, a useful size being 6 in. by 5 in. The gauge of the metal need not be more than No. 18 S.W.G., for the process of bending it to the semi-circular shape is enough to stiffen it.

The $\frac{1}{4}$ in. round rod should be about 7 in. long with about 3 in. of the length flattened out. This can be done by bringing the metal to a red heat and hammering it on the face of an old flat iron suitably supported on a block of wood. The rod is bent upwards from the flat portion and the round end pointed with a file to the shape shown at Fig. 3.

The handle can be shaped with a spokeshave, from a piece of round wood as shown at Fig. 4, but if it is possible to obtain the use of a lathe, the shaping will be quite simple. The end of the handle should be fitted with a $\frac{5}{8}$ in. length of either $\frac{5}{8}$ in. or $\frac{3}{4}$ in. brass tube. Bore a hole first before the rod is driven in.

Of the three forms of rivet in general use, as at A, B and C, the latter is most suitable. Holes should be drilled in the shaped plate and through the flattened portion of the rod, care being taken that correct measurements are made. The hole on the underside of the flat rod should be countersunk and then the rivets hammered over, first as at Fig. 5, and finally as shown at Fig. 6.

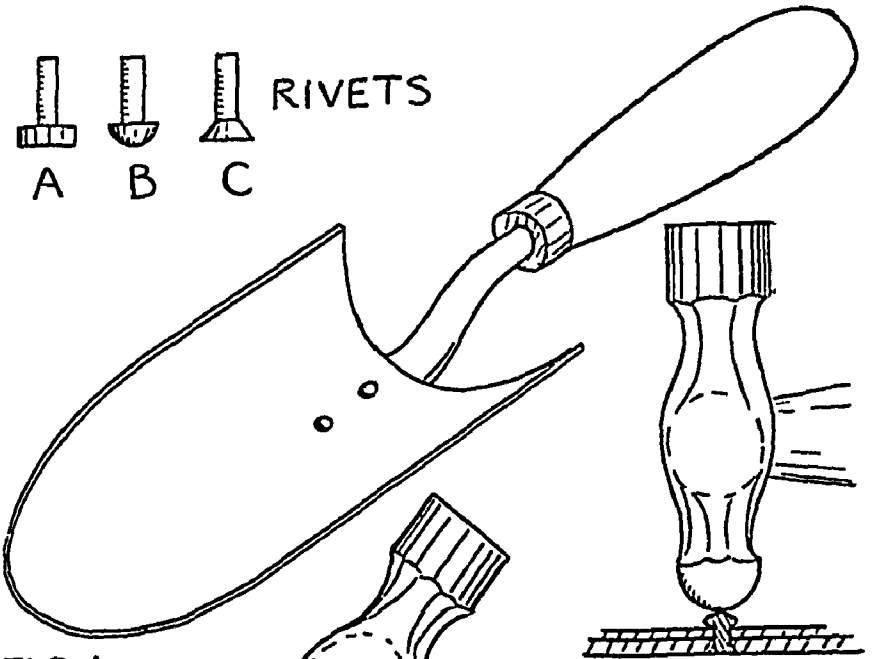


FIG 1.

FIG 5

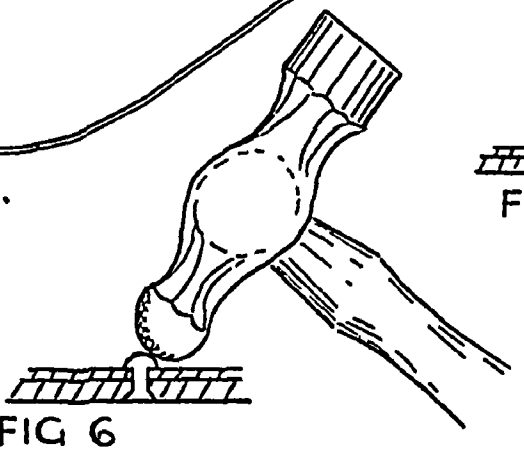


FIG 6

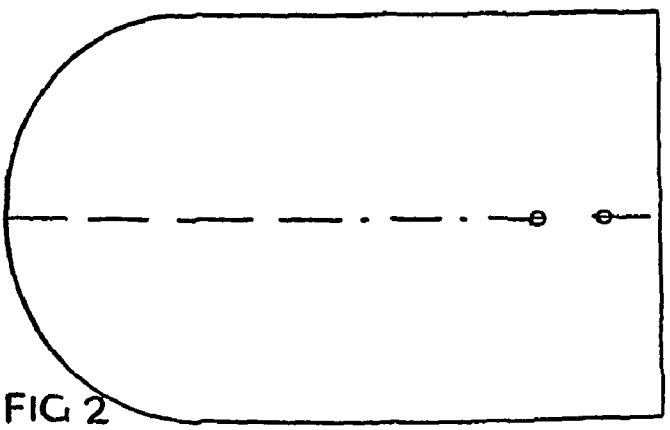


FIG 2



FIG 3

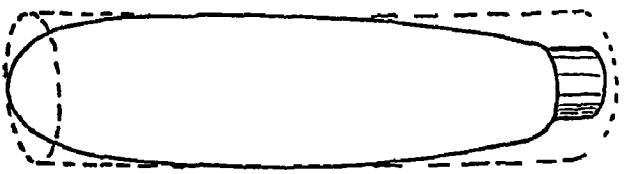




FIG.4

A SIMPLE GATE LATCH

Latches for garden gates and other purposes can be made from bar iron or steel, a suitable size for the material being $\frac{3}{4}$ in. by $\frac{3}{16}$ in., or $\frac{1}{8}$ in. The design given at Fig. 1 is simple to make, as nothing in the way of forge work is needed.

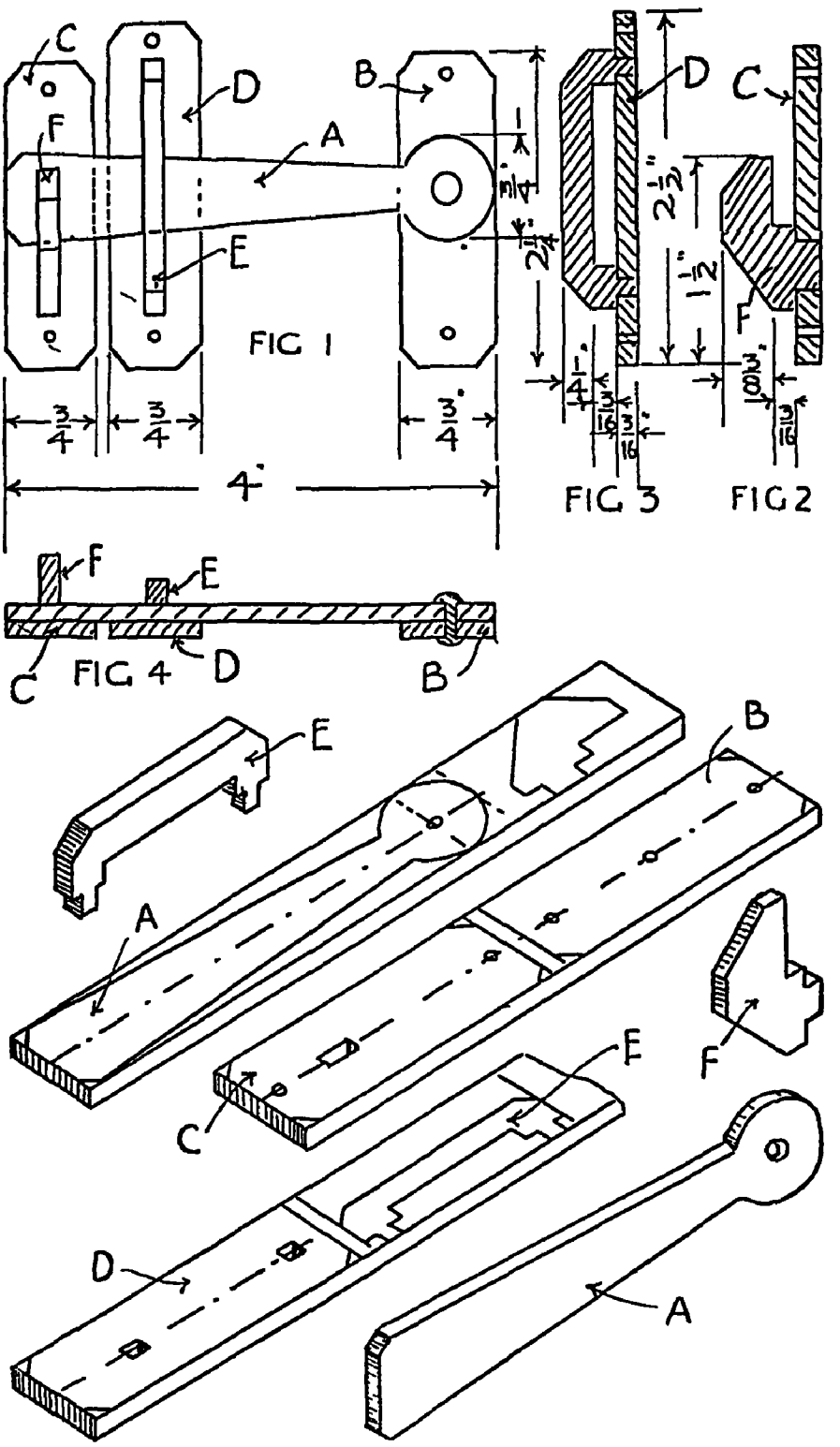
The plate at A forms the latch and measures 4 in. by $\frac{3}{4}$ in. The circular end is $\frac{1}{4}$ in. diameter, and the hole should be large enough to take the $\frac{1}{8}$ in. rivet required to attach it to the back plate B, which measures $2\frac{1}{4}$ in. by $\frac{3}{4}$ in. The corners of this plate are filed and a hole drilled for the rivet.

The latch plate at C is made to the same size as the back plate, but the guard plate at D is $2\frac{1}{2}$ in. by $\frac{3}{4}$ in., with the corners filed in the same way as the others.

The staple at E, which fits on the plate D, is filed to the shape shown and is rivetted securely. Mark off a length of $1\frac{7}{8}$ in., allow for the thickness of the material twice, and then add $\frac{1}{4}$ in. File out for a distance of $1\frac{1}{4}$ in. to leave equal portions at the end. On the projections left, file off portions to leave sufficient for rivetting.

The catch at F is filed to shape from a piece measuring $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. Mark out the shape carefully and leave a projection of about $\frac{1}{4}$ in. for rivetting. Holes are now drilled and filed in the pieces C and D, to take the shaped pieces, they are then placed in a vice and hammered up tightly.

The section at Fig. 4 shows how the various parts fit together. The latch plate should be rivetted so that it will move easily. Finally, holes should be drilled for screws, one hole top and bottom of each piece.


C
D
B
F
A
E
FIG 1
3/4
3/4
3/4
4"
2 1/4"
1 3/4"
D
C
2 1/2"
1 1/2"
F
1/4"
3/16
3/16
1/8"
3/16
FIG 3
FIG 2
F
E
C
FIG 4
D
B
E
B
A
C
E
F
D
A

PASSE PARTOUT PICTURE FRAMING

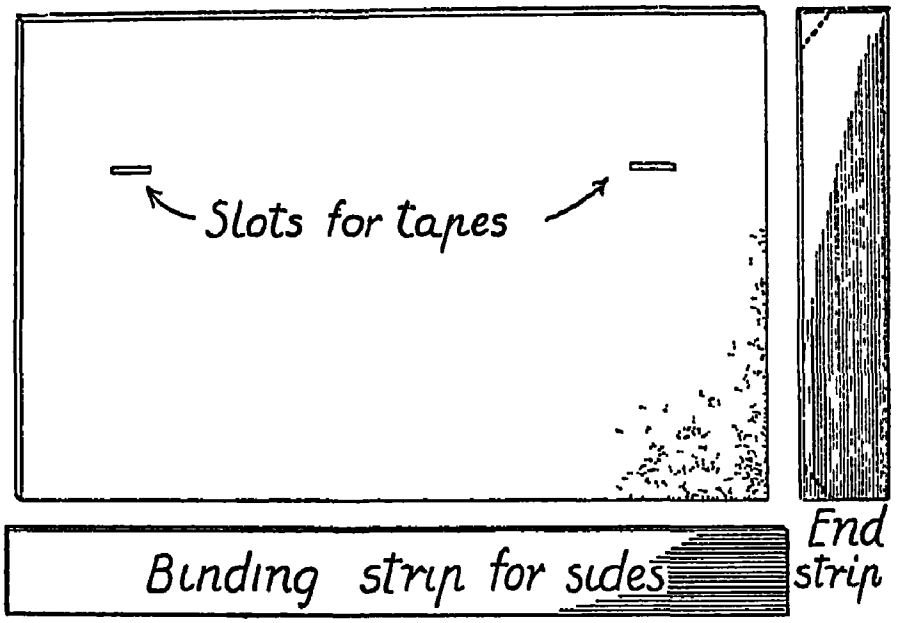
The process is shown on the diagram on the next page. Some pictures look better if they are framed up to the edges, others will look much more effective if they are mounted on a piece of white or tinted paper. The picture can be mounted with an even border, or so placed that there is a larger margin at the bottom.

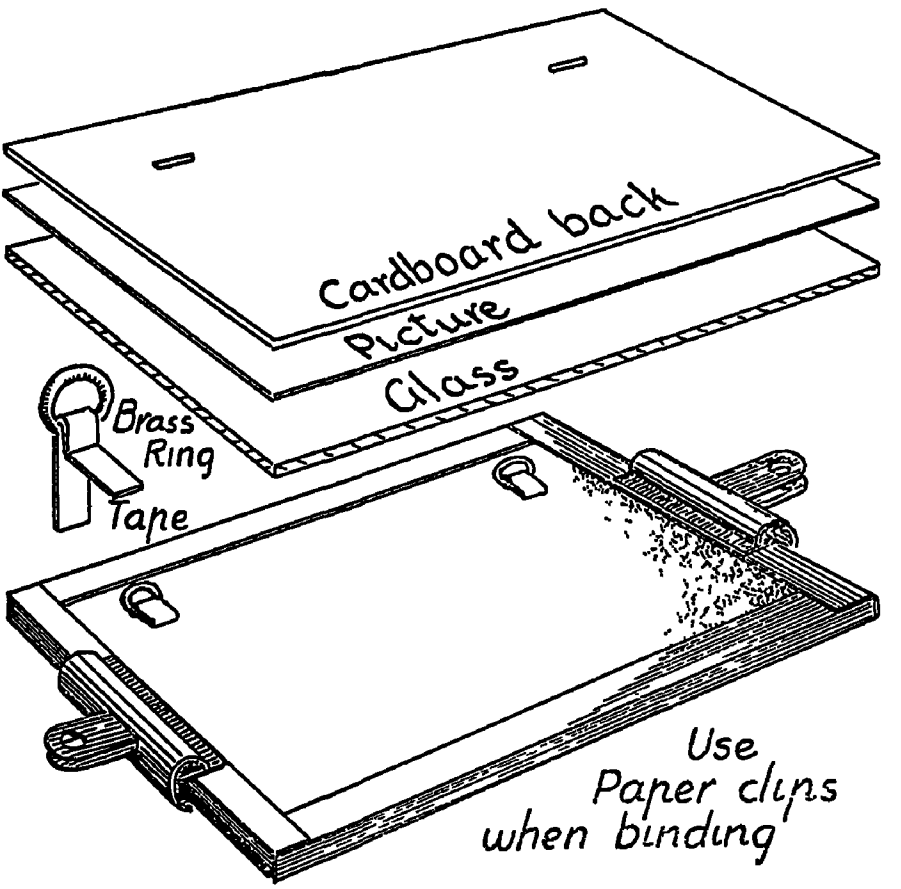
Having decided on the size of the picture and mounted it on paper, if this method is adopted, cut out a piece of stout cardboard to the same size. Provide also a piece of glass to the same size.

Although specially prepared rings for hanging the picture are available, the strongest method is to use small brass rings; attach them to a short length of tape and pass the tape through slots cut in the cardboard back as indicated. If the tape is glued to the inside of the back, the ring will be perfectly secure.

To start the binding, provide the special adhesive tape sold for the purpose, cut two lengths equal to the ends and two about $\frac{1}{4}$ in. longer than the sides. Now rule some lines on a piece of paper to the exact size of the glass, and then draw other lines inside $\frac{1}{4}$ in. away. Produce these lines so that they can be seen when the glass is placed down flat.

The paper strips are damped and are placed down on the glass on the long sides, the edges are turned up and pressed on the back and the binding smoothed down with a soft cloth. Press the projecting corners down, cutting away surplus tape. Finally stick on the end pieces, first mitreing the corners as shown.


Slots for tapes
End strip
Binding strip for sides


Cardboard back
Picture
Glass
Brass Ring
Tape
Use Paper clips when binding

PICTURE FRAMING

One piece of apparatus is essential and that is a true mitre block. A suitable block is shown at Fig. 1, made of beech; it is not expensive, but the experienced boy will be able to make one himself if he can obtain a well-seasoned piece of beech. The necessary measurements have been included for this purpose.

Another form of block is shown at Fig. 2, it is in many ways better than the simple block at Fig. 1. If made at home, the greatest care must be taken in marking out and sawing.

Having procured the moulding, mark off the size of the picture or the glass on the rebate, then place it in the block and saw off. The moulding must be held firmly; in using the block at Fig. 2, saw the two long sides of one side of the block, and the short sides on the other side. Begin the saw cut with the saw raised as at Fig. 3, but gradually bring it to a level position, hold it quite upright and grasp the moulding without movement.

The mitres can be nailed together in the way shown at Fig. 4. It will be seen that the horizontal piece projects slightly, this projection will disappear as the nailing proceeds. Either fine panel pins or oval brads should be used in nailing.

In addition to nailing it is always advisable to glue the mitres, and in this case a cramp of some kind is essential. Special cramps are made for the purpose, but a method which is quite effective is shown at Figs. 5 and 6. The corner pieces at Fig. 5 are made in beech or some other hardwood, the clamping is done by means of a twisted cord as indicated at Fig. 6.

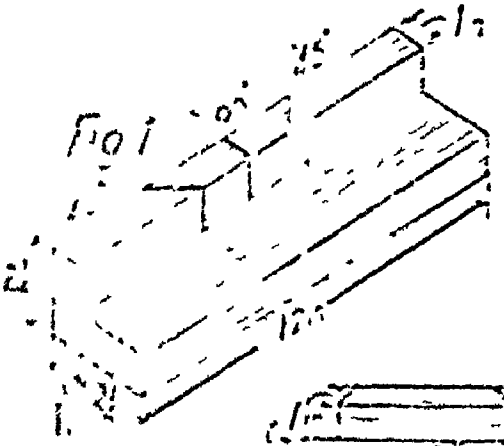
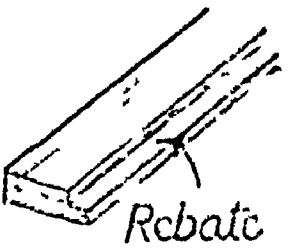


Fig 1



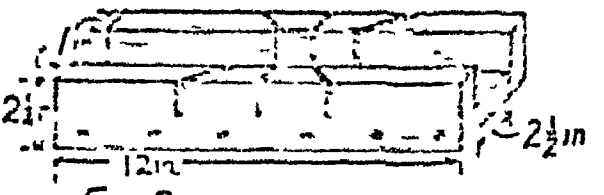


Fig 2

Fig 5



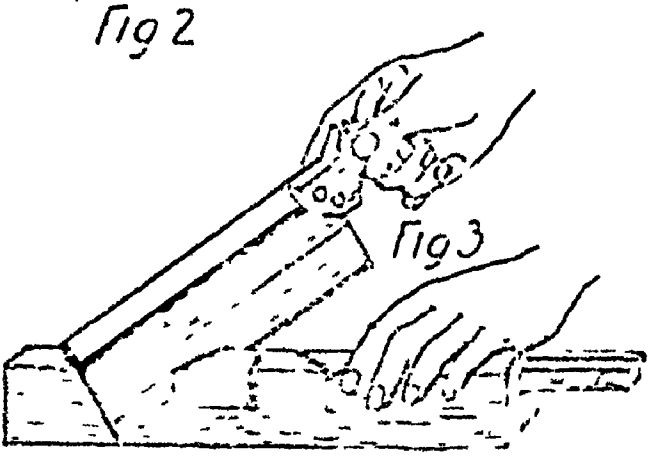


Fig 3

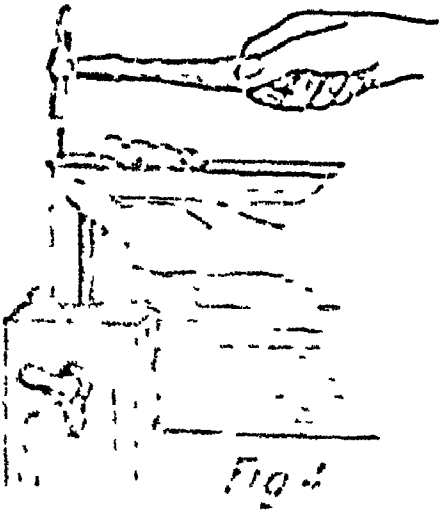


Fig 4

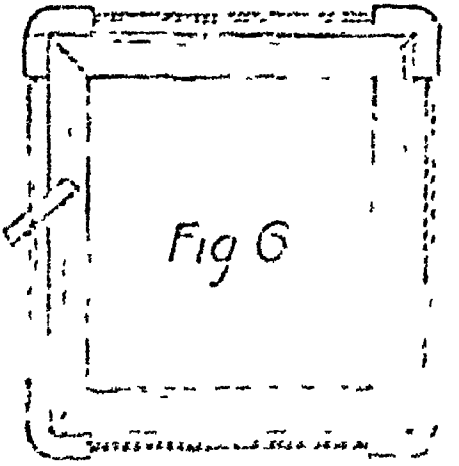
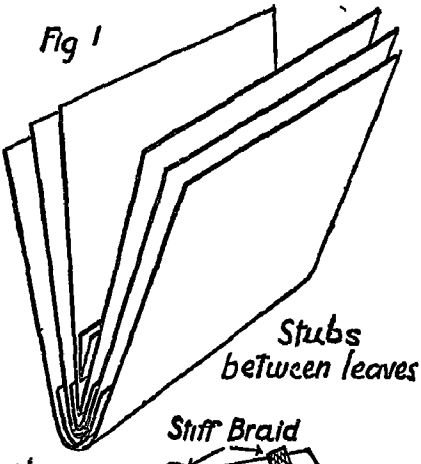
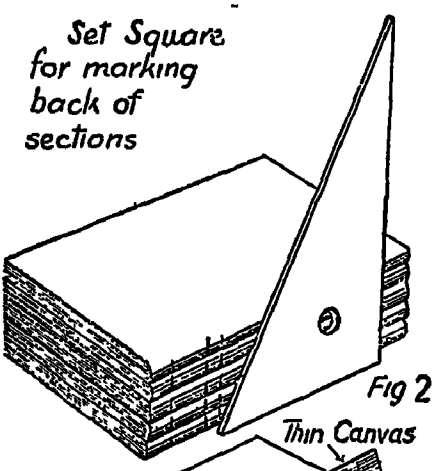


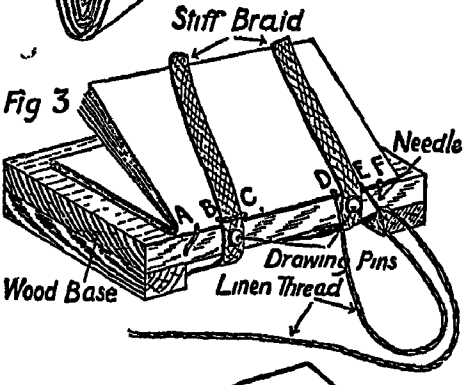
Fig 6

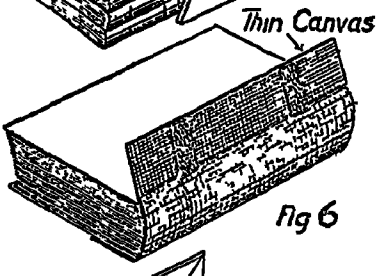
SIMPLE BOOKBINDING

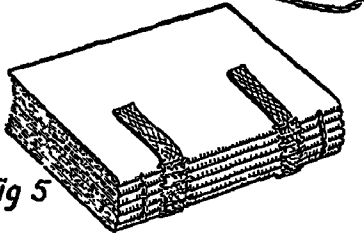
Magazines soon get lost if they are not kept in a special folder or case and even then are liable to disappear. The better plan is to sew the parts together and fit them with a cover. Allowance can be made for added pages, etc., by means of stubs, as at Fig. 1, on page 151. In the first place covers are removed and wire staples, if any, carefully pulled out. Next they are placed in order with the earliest section on top, as shown at Fig. 2, and then the sewing board prepared. This is a piece of wood larger than the size of the sheet with battens at each end. The next step is to provide some stiff braid or tape, wide linen tape will do if coated with glue and left to dry. The first section of the book is placed on the board and about 8 in. of tape pinned to the front edge in such a position that about 1½ in. or so of the section is left outside, this is indicated at Fig. 3. Now provide a long needle, those used for crewel work are most suitable, and some linen thread, then commencing at the left hand end, push the needle through to the centre pages, as shown at A. Pull the thread through to within 2 in. of the end and then bring the needle out again alongside the tape as at B, pass across the tape C and through the pages to D. The needle is now pushed through from the front at E, and is finally brought out at F, as indicated at Fig. 4. The next section is placed on top, opened out and the process reversed in order, and when the end is reached, the free end left at A is tied to the thread. A third section is now placed on top and the same procedure followed and this is repeated in each


Fig 1
Stubs between leaves


Set Square for marking back of sections
Fig 2


Fig 3
Stiff Braid
Needle
A
B
C
D
E
F
Drawing Pins
Linen Thread
Wood Base


Thin Canvas
Fig 6


Fig 5

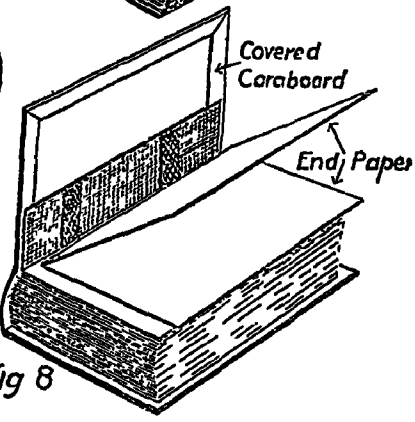
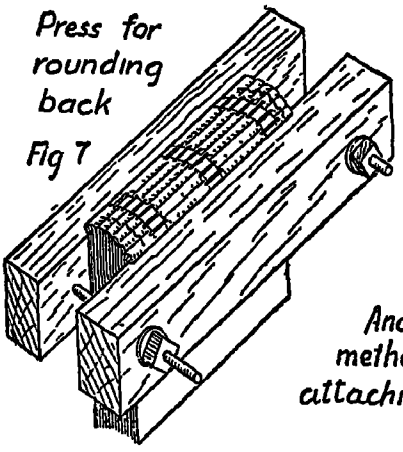
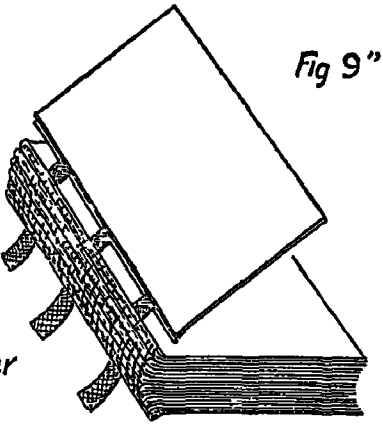

Covered Cardboard
End Paper


Fig 4
A B C D E F
Fig 8


Press for rounding back
Fig 7


Fig 9"
Another method of attaching cover

section until complete. The bound pages will appear as at Fig. 5, and at this stage the pages are placed under pressure, and if desired the edges can be trimmed with a sharp knife. The next stage as at Fig. 6, consists in glueing on a strip of muslin or canvas to cover the back and also secure the tapes. It is an advantage to round the back by placing the sewn book in a press as shown at Fig. 7. The cover is made from two pieces of cardboard slightly larger than the size of the pages and covered with some suitable material, bookbinder's cloth, casement cloth, vegetable parchment or paper, brown or coloured, as shown at Fig. 8. The method is the same as that shown on page 25, at Fig. 3, but to a larger scale. The edge of the material is pasted on the inside of cover and sufficient space left to allow for the thickness of the back. Another method of attaching the back boards is shown at Fig. 9. The end papers, Fig. 8, are prepared to fit in between the covers and the pages.

SCRAP AND NOTE BOOKS

A much more simple method of binding can be carried out by the loosé-leaf method as shown on the next page. The actual size of the paper used does not matter as the procedure is the same.

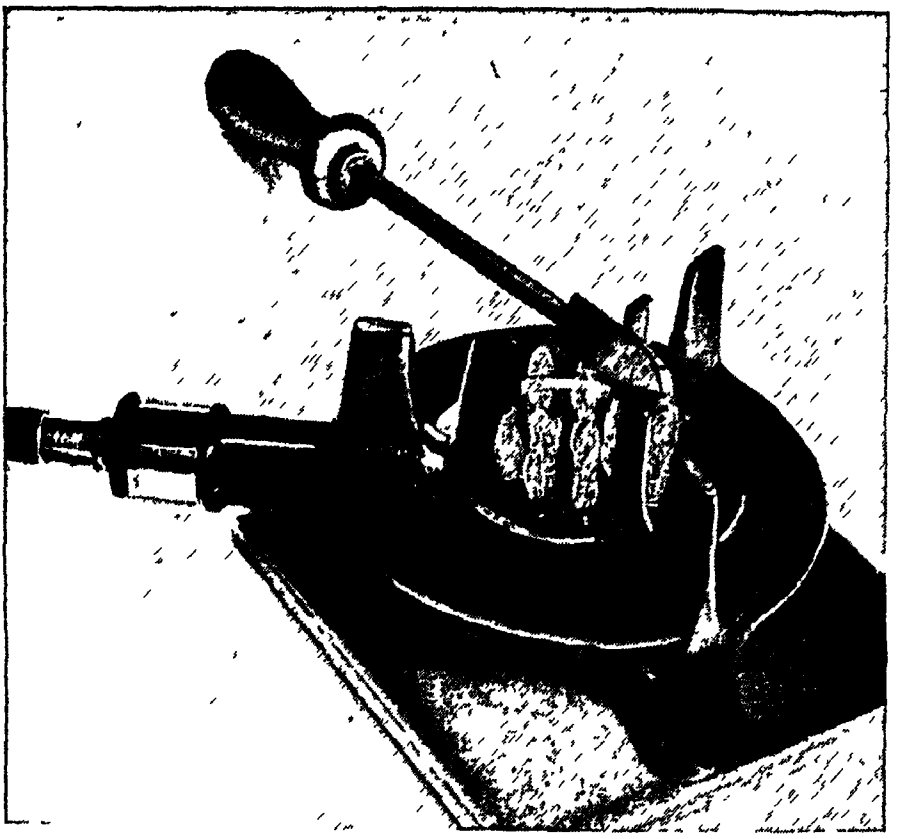
Prepare the pages as shown and then mark out a cardboard strip to the width of the page. Set out three points as indicated and then, using a saddler's punch, make the holes as shown.

The template is used for punching holes in all the sheets, which are then threaded together over a suitable cover and tied with fine cord.



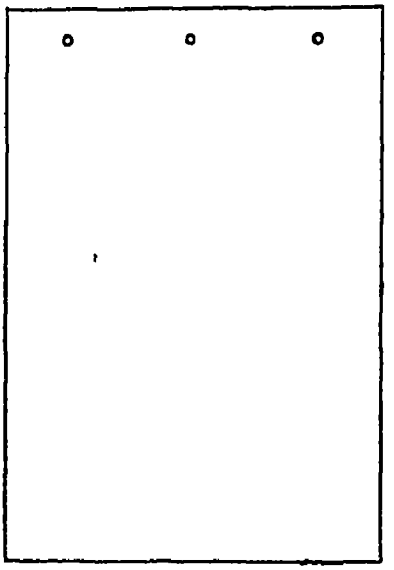
28 USING OIL-VARNISH STAIN

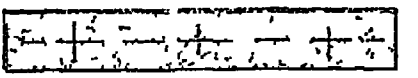
BY USING A GOOD OIL-VARNISH STAIN, THE GRAIN OF THE WOOD IS ENHANCED, SPIRIT VARNISHES HIDE THE GRAIN AND ARE MORE DIFFICULT TO APPLY

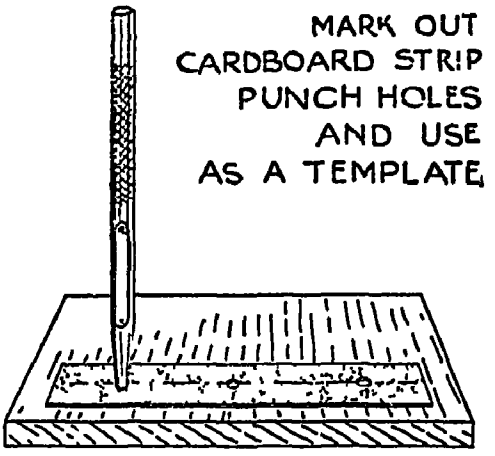


29 HEATING A SOLDERING BIT

A GAS RING PROVIDES A USEFUL HEATER FOR THE SOLDERING BIT
DO NOT LET THE COPPER BIT GET TOO HOT



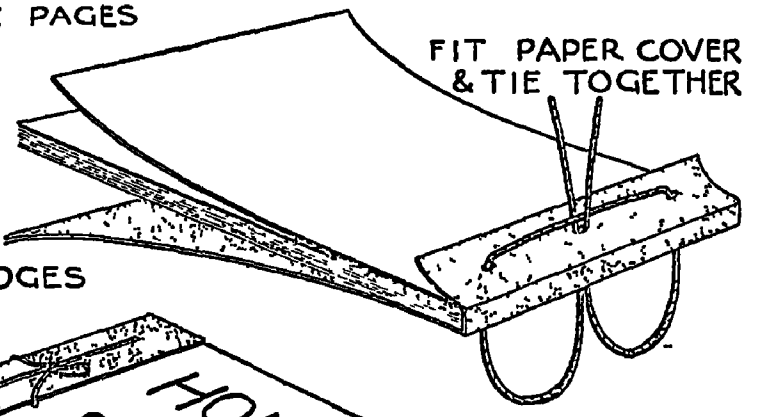




MARK OUT CARDBOARD STRIP PUNCH HOLES AND USE AS A TEMPLATE

PREPARE PAGES TO SIZE

FIT PAPER COVER & TIE TOGETHER



TRIM EDGES



PRINT TITLE IN CAPITAL LETTERS

OR DECORATIVE LETTERS



MAKING STENCILS

Stencils are useful for many kinds of decorative work, especially for the covers of note books, etc. Before using paint on drawing paper, it must be coated with linseed oil or spirit varnish. Specially treated paper, ready for use, is inexpensive.

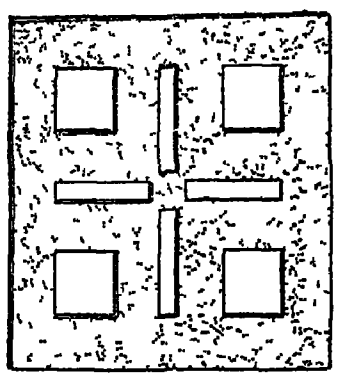
An ordinary pen knife can be used, but stencil cutters as shown in the diagram are available. One or two stencil brushes will be needed.

For black work, a moistened cake of Indian ink will do, but water colour is suitable. Oil colour should be used on fabrics. Mix to a creamy consistency and spread on a felt pad.

It is an advantage to have some practice in cutting the stencil before anything elaborate is attempted. Two suggestions are given at the top of the next page, one composed of straight lines only, the other with some curves. It is advisable to do all cutting freehand and if the knife or cutter is held firmly and is under complete control, no difficulty should be experienced in cutting.

In applying the paint or ink, press the brush on the pad or cake and then apply the stencil with vertical strokes. Do not be tempted to rub the brush, but dab it down gently over the space. Lift up the stencil plate carefully and be careful not to move it during the work.

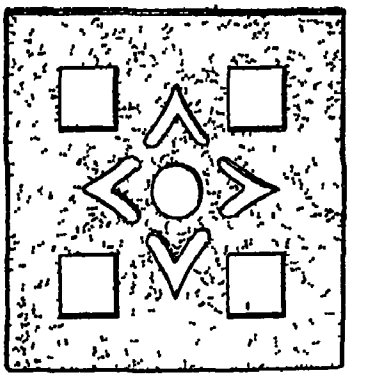
Some suggestions are given at the bottom of the page for suitable lettering. The plain block letter so often seen is not so pleasing as the curved letter. The advantage of using the style of lettering shown over the block letter is the absence of the "tie," and is noticable in such letters as O, B and C., etc.



SQUARE CUTS



BRUSH



CURVED CUTS



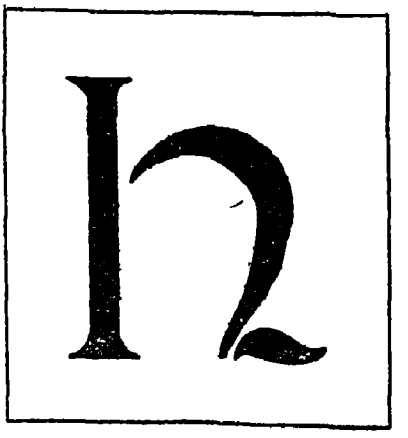
FELT PAD FOR PAINT OR INK

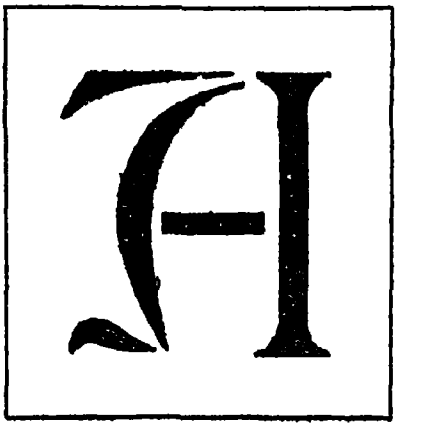
HOW TO HOLD THE CUTTING KNIFE

LINO OR ZINC PLATE



SUGGESTIONS FOR STENCILLED LETTERS





SIMPLE CARVING

A considerable amount of decorative work can be done on wood with a knife, but with the addition of a veining tool, a V tool and a firmer gouge quite elaborate carving can be carried out.

One of the earliest forms is that known as chip carving. In its simplest form it is shown at Fig. 1. A sharp knife is dug into the wood at an angle so that a small chip is removed. The frame at Fig. 3 is a typical example of what is possible.

The veining tool, which is actually a small gouge, will give the shapes shown at Fig. 2. An application of the same cuts is shown at Fig. 4.

To be successful, special attention should be paid to the tools. Provide a small gouge slip, this is a narrow piece of oilstone. Use with it just sufficient oil to keep the surface moist. Have also a strip of leather which may be glued to a strip of wood and after sharpening rub the edge on the leather to remove the wire edge.

After the first cuts have been practised, control over the tool can be gained by attempting curves as shown at Fig. 5. Work generally against the grain rather than with it as the tool is liable to run with the grain and pull it up. The round holes are formed by holding the gouge upright.

The pattern for chip carving shown at Fig. 6 is easily done on a soft wood, but after a little practice in soft, try some sycamore or holly.

A suggestion is given at Fig. 7 for a finger plate which is decorated on the edges by simple knife cuts. There are considerable possibilities for the decorative treatment of many articles in wood and linoleum by using knife cuts made similarly.



FIG 1.



FIG. 2

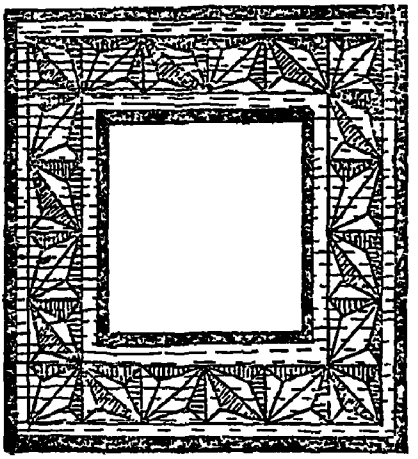


FIG 3

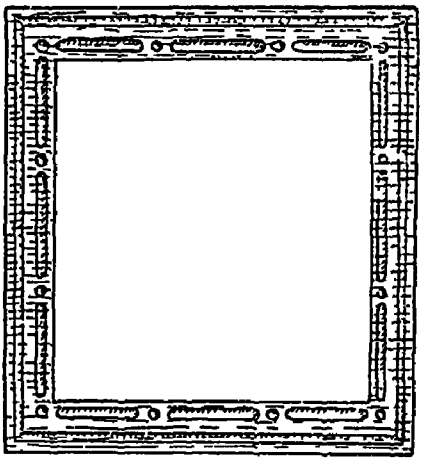


FIG 4.

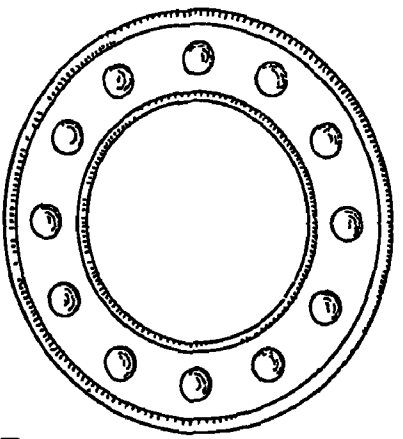


FIG 5

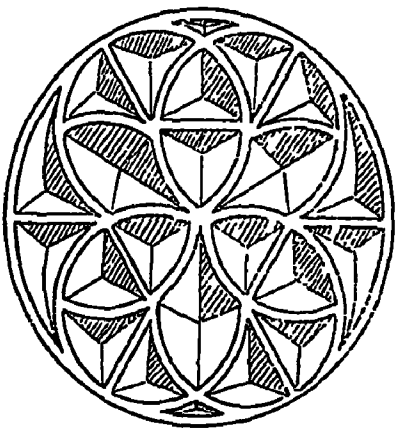


FIG 6

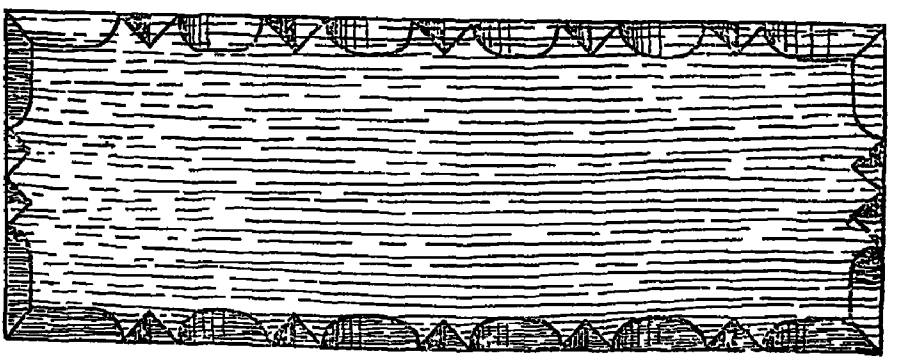


FIG. 7

CUTTING LETTER STAMPS IN LINO

Initial letters and monograms are easily made for printing purposes in fairly thick linoleum. The material can be obtained quite easily and odd pieces which otherwise would be wasted can be obtained for a few pence at many furnishing stores.

In making a block of the latter A, shown on the next page, first draw it out to the size required. For a beginning it should be about 4 in. square. Make a tracing from the drawing and either paste the tracing down on to the piece of lino, or trace it through with carbon paper. In all cases the design must be reversed on the block.

A set of tools for lino cutting can be obtained at all shops stocking artist's materials; they are in the form shown on the next page and are something like pen-nibs, which are fitted in a handle. A lot of work can be done with two sizes of divider and gouge, if desired, a sharp pen-knife can be used instead of the cutting knife shown.

The tool should be held firmly in the right hand, with the other hand grasping the piece of linoleum. The outline can be cut first of all, sloping the knife slightly. Care must be taken not to undercut anywhere because the lino is likely to break away. Only the lightest pressure is needed to cut the material away and special care is needed when approaching the end of the cut.

The ground should be cut away about $\frac{1}{8}$ in. deep, there is no need to cut down to the canvas backing. If this should happen, the lino should be glued to a piece of plywood.

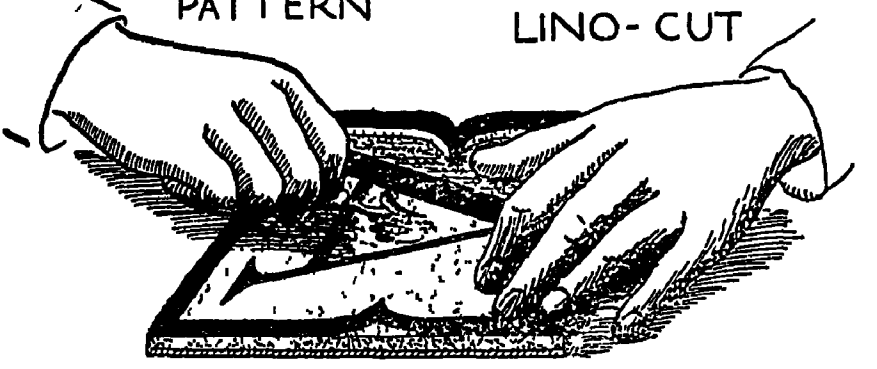
Printing can be done with ordinary printer's ink, but prepared lino printing ink is sold in tubes



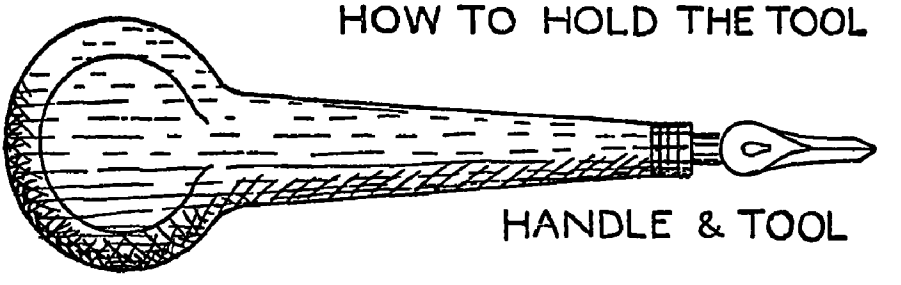
PATTERN



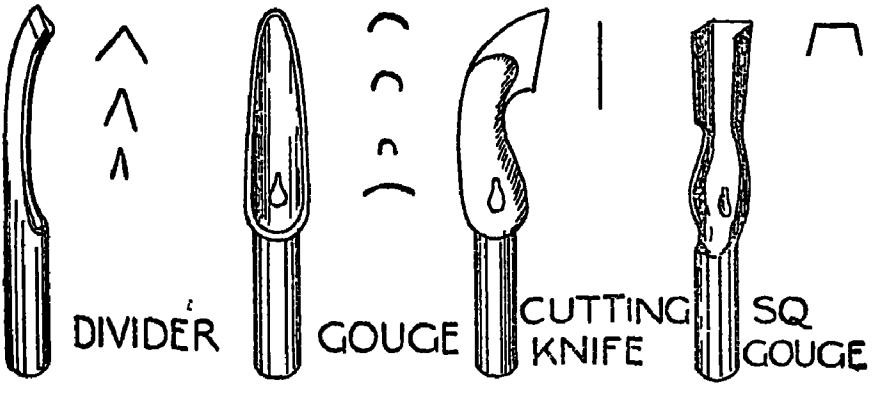
LINO-CUT



HOW TO HOLD THE TOOL



HANDLE & TOOL



DIVIDER GOUGE CUTTING KNIFE SQ GOUGE

ready for use. Suitable water colour printing ink can be made by using dry powder colours mixed with starch paste; the best paste is made with rice flour. A black ink can be made by placing a cake of Indian ink in a cup of water, leaving it for a few days to swell, then the water is poured off and the ink mixed up with rice paste.

Spread the ink on glass and apply it to the block with a stiff brush or a rubber roller.

The printing paper should not be glazed. Newsprint or kitchen paper is suitable, also the paper used for cyclo-styling. The best, however, is mulberry paper. Although dry paper can be used, it is better to use it when slightly damp.

Immediately after the block has been coated with ink or paint, place the paper over very carefully and then rub it with a clean rubber roller or with a flat piece of wood, known as a baren. A suitable tool can be made by covering a round or rectangular block of wood with corrugated paper and then cover again with vegetable parchment or grease proof paper. The latter can be tied in a bunch at the top.

The surface of the printing paper should be rubbed evenly and lightly; when the pattern shows through, pull it off and place on one side.

The suggestions given on the next page provide for a considerable amount of practise work in lino cutting. The patterns at Figs. 1 and 2 show the possibilities for simple decorative blocks. A line of simple monograms are given at Fig. 3.

The patterns at Fig. 4 are a little more elaborate, but, if they are drawn out carefully, the cutting is quite simple. Subjects similar to those shown at Fig. 5 will provide for much interesting work.

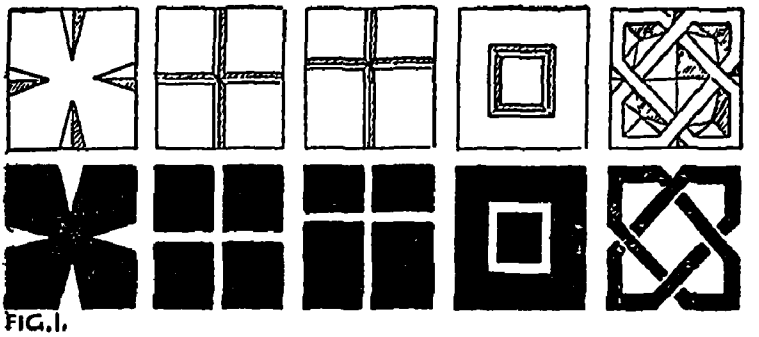


FIG. 1.

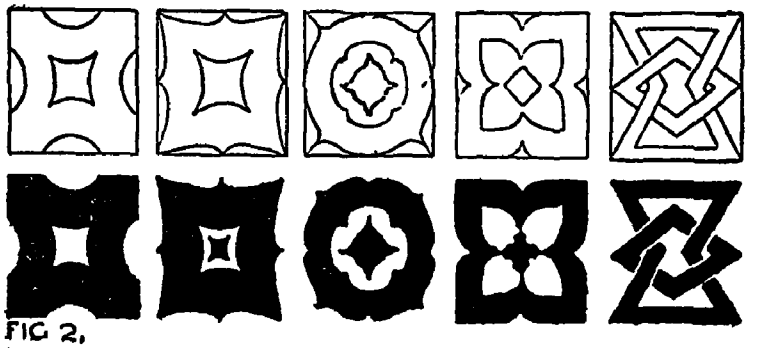


FIG 2.



FIG 3

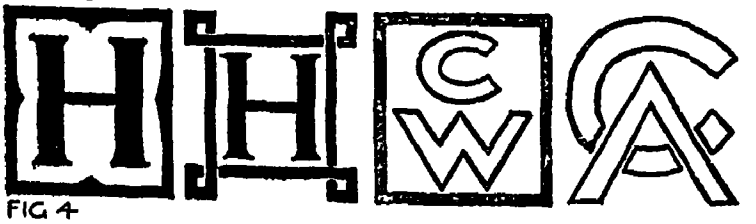


FIG 4

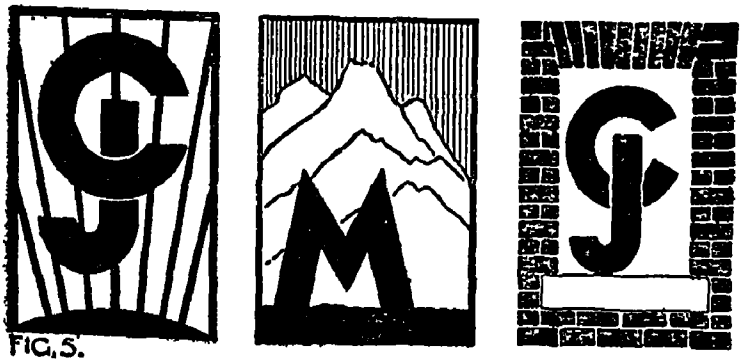


FIG. 5.

MAKING CHRISTMAS CARDS

Making Christmas cards is an interesting job, and there is a fascination about designing something different that will appeal to the boy who is fond of drawing and lettering.

The illustrations are suggestive and show four different ways of making greeting cards easily.

If a few cards only are required, it is a good plan to get some handmade paper, such as Whatman's, and use either water colours or poster colours to work out the design with a brush. The lettering can be done with a pen and Indian ink.

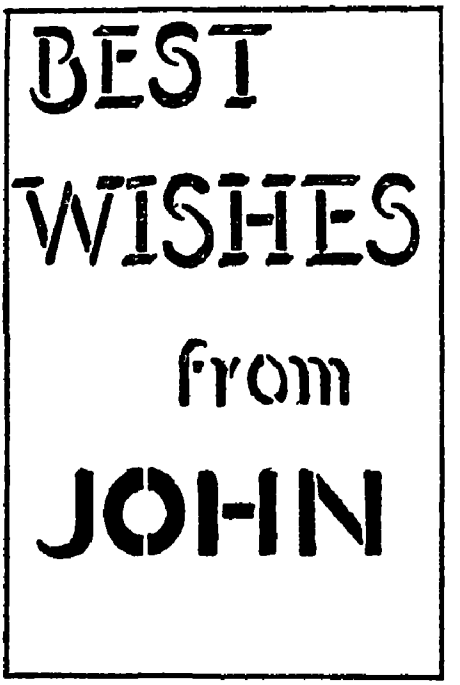
The suggestion for stencilling can be carried out by following the directions for cutting and inking as shown on page 155. The letters shown on that page can be used as well as those shown on the design. Stencilling is useful when a large number of cards are required. The printing can be done on handmade paper, it costs a little more than drawing or notepaper, but it looks much better.

When a considerable number of cards are required the lino-cut is ideal for the purpose. An elaborate lettered design as shown on the next page should not be beyond the skill of a boy who has followed out the instructions on page 159.

The design suggested for a colour lino-cut can be worked out in two or more colours by making blocks for each colour and making separate prints. For a colour print it is advisable to make the blocks large enough to provide a border on two sides of the block. This border is not inked, but intended to provide a corner in which the paper can be fitted to obtain the correct position. The block can be glued to plywood, pins used as a guide.



PAINT & BRUSH



STENCILLING



LINO-CUT LETTERS



COLOUR LINO-CUT

A MODEL THEATRE

The design shown on the next page is the work of a boy who has experimented with model theatres with a view of producing a portable stage for use with small puppets.

It will be seen that the platform is composed of box made of thin plywood to a length of 42 in. and a depth of 30 in. The depth of 4 in. is convenient, as it provides plenty of room for carrying the puppets and the scenery.

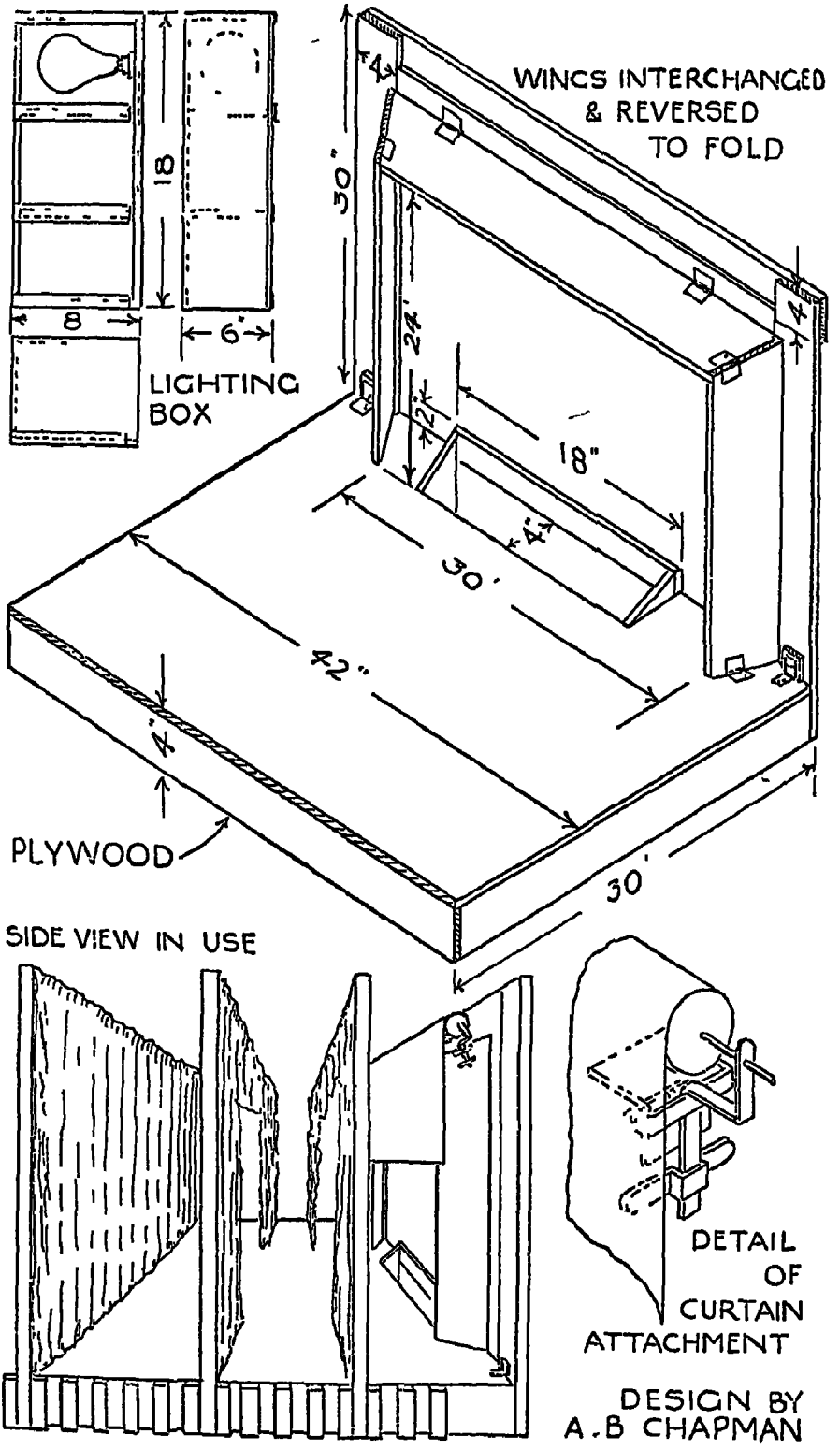
The front of the stage is composed of two 34 in. by 4 in. strips glued and bradded to a 42 in. by 4 in. strip. It is hinged to the floor by small back-flap hinges screwed to small block cut from plywood.

The sloping pieces are attached to the back of the frame, make them from 4 in. to 6 in. wide, and hinge the top piece to a 2 in. wide strip glued to the top bar. The side pieces can be hinged to the upper portion and either hinged or pinned to the floor.

A suggestion is given for lighting, the front of the stage can be cut away as shown and also a special lighting box can be made as shown in a separate sketch.

Scenery can be fitted in position, by means of uprights fitted in slots at the side of the stage. The uprights should be from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. square and suitable blocks nailed to the side so that the uprights can be placed in any desired position.

The scenery can be painted on canvas and threaded on wire or string, it can then be attached in some convenient way to the top of the posts and easily detached.


WINGS INTERCHANGED
& REVERSED
TO FOLD
18
8
6"
LIGHTING
BOX
30"
4"
24"
2"
18"
4"
30"
42"
4"
PLYWOOD
30"
SIDE VIEW IN USE
DETAIL
OF
CURTAIN
ATTACHMENT
DESIGN BY
A.B CHAPMAN

MAKING A HOME MUSEUM

There are very few homes where a number of curiosities of nature or of manufacture are not to be found, and it is an interesting occupation to collect and label them, and add to the collection from time to time. It is interesting to keep mementos and records of holidays, and readers who are keen on geology or nature study will like to keep the results of their labours in an accessible form.

The easiest method of arranging the museum specimens is to make a number of boxes with slip-in glass lids, as shown at Fig. 1, and arrange the boxes on shelves; cardboard or thin wood partitions can be fitted in the boxes to suit the particular specimens. Scrap books can be made, as shown at Fig. 2, the stubs will allow for the thickness of the insets and the book can be bound up in a case, as shown at Figs. 3 and 4, and adapted to hold dried leaves and flowers. Shallow boxes with glass lids can be used to form collections illustrating the bark, leaves, flowers and the fruit of trees.

Leaves and flowers pressed between sheets of blotting paper soaked in oxalic acid and dried, will retain their original colouring for a long time. Fruits can be varnished or preserved in alcohol. Ancient flints, Roman pottery and old coins will form the basis of interesting collections and the seashore will provide material such as shells, pebbles, seaweed, flowers and plants.

A convenient case easily made from plywood by any handy boy is shown at Fig. 5. The drawers can be made similarly to the covered tray shown at Fig. 1, with small drawer knobs fastened to the far side.

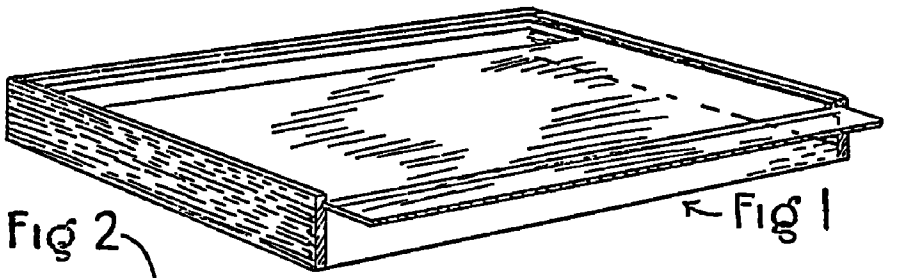


Fig 1

Fig 2

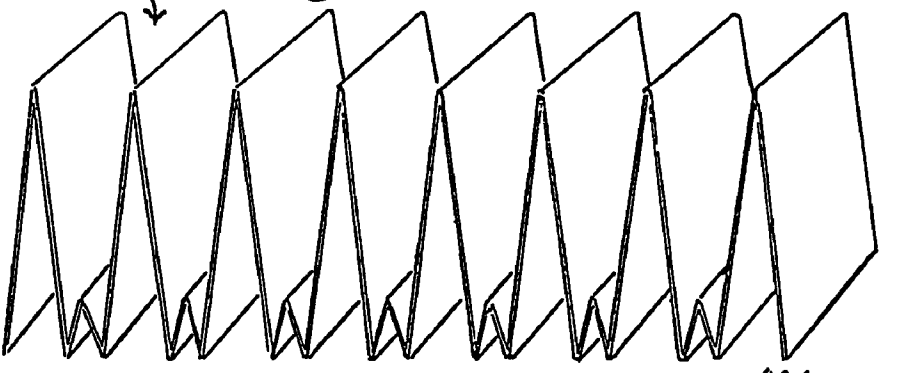


Fig. 3

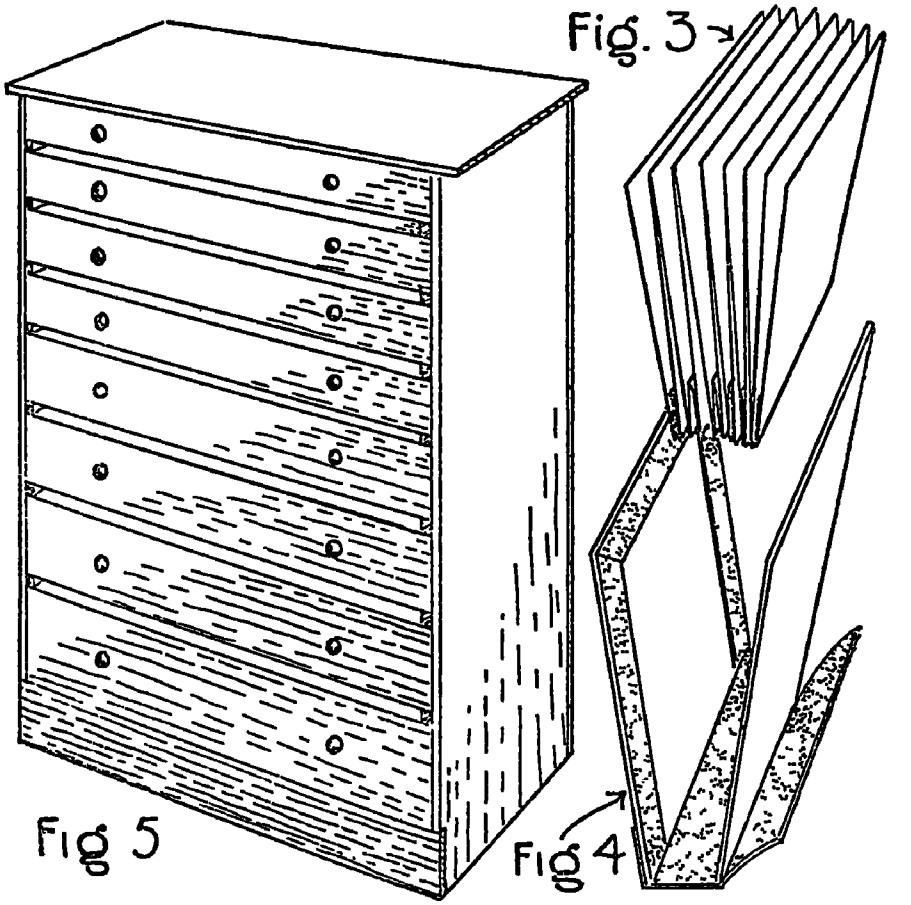


Fig 5

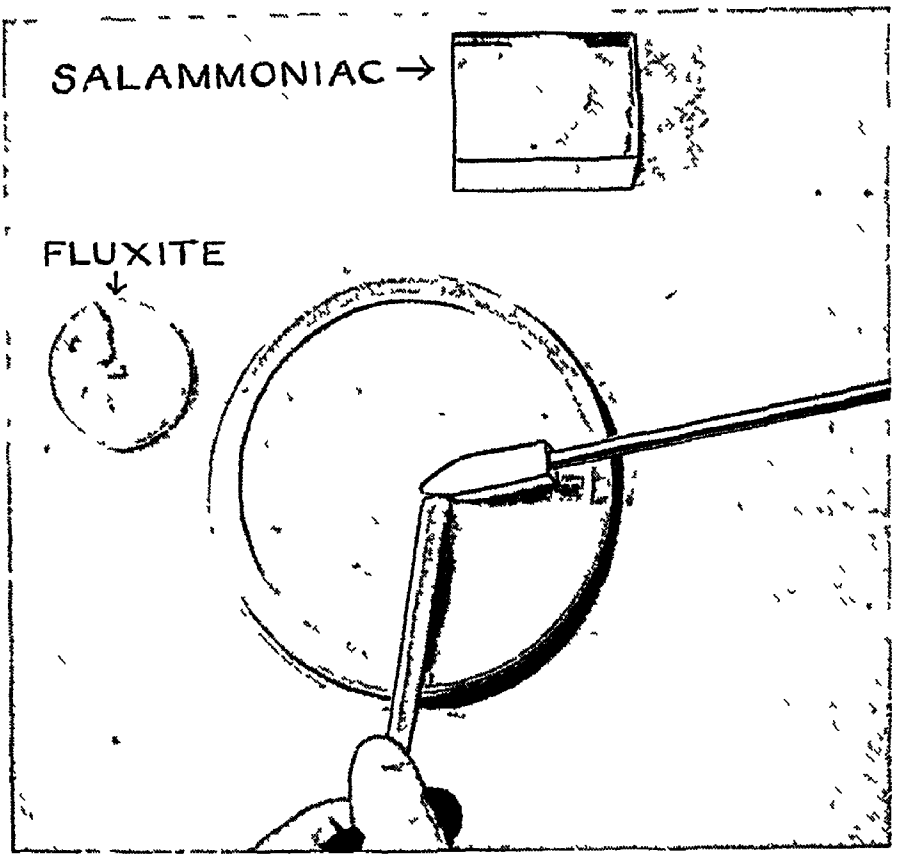
Fig 4

THE ART OF SOLDERING

Many boys have tried to do small soldering jobs and failed mainly because they have not appreciated the necessity of the first essential of successful soldering, that of cleanliness. Solder will run only on a perfectly bright metal surface coated with a flux. The air acts very quickly on all metals and forms a film of oxide on which solder will not flow; it is therefore most important that the portion of the metal to be soldered must be scraped bright. It is also important to have a good copper bit, or soldering iron as it is called. The piece of copper should be rectangular and about ½ in. square in section, and weigh ½ lb. or so, it should be rivetted to an iron shaft attached to a large wooden handle.

It is necessary to have some flux, this is used in the form of a liquid or a paste, to spread on the work before soldering to enable the solder to flow over the prepared surface. The commonest form of flux is killed spirits made by placing small pieces of zinc in a stone jar half filled with spirits of salts, known also as hydrochloric acid. As this liquid is poisonous and liable to damage the clothes, the more convenient paste flux is advised. A length or two of ordinary tinman's solder, an old pocket knife, a worn flat file or two will complete the equipment.

For the sake of example we will suppose we have a small kettle to mend. First of all the metal surrounding the leaky places should be thoroughly cleaned by actual scraping in order to obtain a perfectly bright surface; this may be done with a knife or file. The flux should be spread over the cleaned portion; a good method is to bruise the



30 SOLDERING

THE SOLDERING BIT AND THE METAL TO BE SOLDERED SHOULD BE FILED BRIGHT RUB THE BIT ON SOME SALAMMONIAC AND COVER THE PORTION TO BE SOLDERED WITH FLUXITE OR OTHER SUITABLE FLUX



31. SOLDERING A PATCH

WHEN REPAIRING A KETTLE OR SAUCEPAN, USE A FILE TO SCRAPE THE METAL QUITE BRIGHT BEFORE APPLYING THE PATCH AND/OR SOLDER

end of a length of cane and use it as a brush. The coating of flux will prevent the air tarnishing the bright surface, as it is important to keep it bright.

In the meantime the soldering bit should be placed over a gas ring until it becomes quite hot but not red-hot. The heating will cause the copper to become dull and a worn file should be used to take off the scale and expose the pure metal underneath. The heated bit should now be dipped into the flux and then touched with the solder. If the heat is right the solder will run over the parts which have been coated with flux. Too high a temperature will cause the flux to generate a lot of steam; a slight sizzle should be heard and a a little vapour should be seen. If on the first touch on the flux, the bit proves to be too hot, a wait of a minute or so will be sufficient to lower the temperature. This method of applying the solder to the end of the bit is called tinning.

We are now ready for actual soldering and if the article is held, say, between the knees or in a vice, and the point of the bit placed in the centre of the cleaned portion, the solder from the bit will run over the surface when it has become hot enough. If there is insufficient solder on the end of the bit, the stick of solder should be placed at the point of intersection of bit and surface and sufficient will melt and run in with the rest. At first the bit may cool off too quickly, especially if the copper end is small, but when reheated, cleaned and tinned again the job may be finished.

A hole in the bottom of the kettle cannot be covered with a lump of solder, it must be patched with a small piece of tinned sheet.

PASTE AND GLUE

There are many uses for paste in the house, among them being paper-hanging, bookbinding and book repairs, mounting scraps and photos, and the making of fancy articles in strawboard or cardboard, which are covered with paper or fabric. Paste and glue, together with gum, are the more commonly used forms of adhesive preparations, paste and gum are mainly used for paper and fabrics, while glue is used for wood. There are other forms of adhesives used for joining up various materials, but they are generally classified under cements.

Paste is usually made either with flour or starch; as a rule it is mixed with water, but sometimes it is made with the addition of a gum to strengthen it. A good flour paste is made by mixing ordinary white or rye flour with water to form a stiff batter without lumps. It is thinned to the consistency of cream, and then boiling water is added slowly, while it is being stirred, until the paste thickens, when it is boiled for 5 minutes. A few drops of oil of cloves or carbolic acid can be added to the paste before it is used, in order to preserve it, but as all flour pastes are liable to become watery and lose their strength, it is usual to mix up sufficient for the work in hand and not to bother about its keeping qualities.

Starch paste is more expensive, but it has excellent sticking qualities, and when a few drops of oil of cloves is added when the paste is cold it can be kept for a long time, particularly if it is stored in an air-tight bottle or jar. A good method of making the paste is to mix a tablespoonful of

ordinary white starch with cold water until it forms a creamy liquid. Boiling water is now poured on to it slowly, stirring all the time, until it thickens and it becomes a translucent jelly. A spoonful of gum arabic is often added to the paste to strengthen it; this can be done while the paste is still hot, but the oil of cloves should not be added until it is cold.

Another method of making flour paste to give it greater tenacity is to add Scotch glue or size after thickening. The method is to mix rye flour to a creamy consistency, add boiling water until the paste thickens, then pour in a quarter of its bulk of melted Scotch glue, or one-third of the bulk of melted concentrated size. The mixture should be boiled up and thoroughly stirred. To preserve it and prevent discolouration, melt $\frac{3}{4}$ oz. of alum in each quart of the mixing water. This paste can be used either hot or cold, but it works easier when hot, and is adapted for use in hanging thick and embossed wallpapers and also for fixing linoleum.

A strong and clean paste for mounting photographs can be made from dextrine, but considerable care is required in making it. One pint of water is placed in an enamelled double saucepan, placed over a gas flame and brought to a temperature of exactly 160° F. Next stir into the water very slowly 10 ozs. of white dextrine, but the temperature must not be allowed to alter and the stirring must be continued until it forms a perfectly clear solution, 3 minims each of oil of cloves and oil of wintergreen are then added. When the solution has cooled, it should be poured into wide necked bottles or jars, covered with a cork, and allowed

to stand undisturbed for about a fortnight. The paste will gradually congeal and become white, when it is ready for use. The paste should not be exposed to the air when not in use, otherwise it will harden and become useless.

Glue is available in several forms, when used in large quantities it is melted up with water from cakes, but for occasional use the various forms of fish glue, usually packed in tube form, are more convenient. Of ordinary cake glues, Scotch is the strongest; French glue is more transparent, but not so strong. Glue loses much of its strength by being repeatedly reheated, so it is advisable to make no more than is necessary for use at one time. The best way to make it is to break up a cake into small pieces, place it in the inner pot of an iron glue pot, cover it with water and leave it for a few hours to form a jelly. The glue is now brought to boiling point, the froth removed, and it is then used as hot as possible. It may be made in a jar placed in a saucepan.

In using glue, the best result is obtained by applying it to the wood after it has been warmed and in a warm room, apply with a bristle brush as rapidly as possible, and take care that the brush has been previously soaked in hot water to prevent the bristles working out. It is not necessary to apply a thick coating, the glue itself should run off the brush easily, and flat surfaces should be rubbed together to exclude all surplus glue, as well as to expel air bubbles. Joints should be cramped together as soon as possible after glueing, and it should be noted that a thick coating of glue will not make up for a slackly made joint. Glue can be

waterproofed to a certain extent by adding about 10 per cent of potassium bichromate solution.

A good liquid glue for ordinary use by melting Scotch glue with slightly less than the same weight of water in the manner described above. When cool, stir in 18 drams of glacial acetic acid to each pound of glue, and a tablespoonful of salicylate of soda. A semi-solid glue, requiring to be warmed before use, can be made by dissolving 4 ozs. of best Scotch glue in 16 ozs. of strong acetic acid. The advantage of ordinary liquid glue, or one of the patent tube glues, is that the adhesive can be applied cold. It sets quickly, but care should be exercised so that a very thin film of the glue is used. On no account should glue be applied to an old glued surface until it has been planed or scraped clean in order to expose the clean wood. This applies to greasy or dirty surfaces, for the utmost cleanliness should be observed, both as regards material and use.

HOW TO DO PAINTING

Most boys at some time or other like to do painting, and should know something about the materials. As paint is used as a preservative as well as a decorative medium, some consideration must be given to the special kind of paint required. It is advisable to use always the best quality available; the best paints are composed of a finely ground base and pigment mixed with superfine oils, with the results that a larger area of surface can be covered than is possible with a cheap paint which as a rule does not retain its colour and is not so durable. When purchasing paint, go to a

reputable firm and state if it is for interior or exterior use; as a rough guide for quantity, one lb. of good paint will cover about 30 sq. ft. on new wood, and about 50 sq. ft. when applied on the top of old paint.

Three brushes are usually required, one with fairly soft bristles is used as a duster before the paint is applied, another, known as a sash tool, is used on narrow surfaces, and the third is a ground brush used for broad surfaces. Before being used for paint, the brushes should be soaked in hot water so that the bristles will tighten up and not work out in use. After use they should be very thoroughly cleaned, either with turpentine or with strong soda water and soap and then dried. If the brushes are likely to be used for the same colour within a short period, they may be suspended in turpentine, but the excess liquid should be pressed out before use by stroking the brush on the side of the receptacle.

The preparation of the surface for painting is generally of more importance than the actual application of the paint. In repainting interior work, the old surface should be thoroughly cleaned with soap and water or strong soda water; it is not sufficient just to wipe the surface over, it should be scrubbed down with a brush in order to remove all grease and dirt, then thoroughly rinsed with clean water and left to dry.

In painting exterior work, much depends on the appearance of the old paint. If the work has been exposed to the heat of the sun and has become blistered, or has become old and brittle, it will be necessary to remove the entire surface; for this

purpose it is usual to use a blow-lamp, burning vapourised paraffin. The flame is applied to the old paint, and when sufficiently soft, the paint can be scraped off with a steel scraper. When the surface is clean, rub it down with glasspaper, or a piece of thick felt, made damp and coated with pumice powder. The surface must be wiped quite clean and then coated with priming, followed by at least two coats of paint. In painting exterior iron or other metal work, it is usual to scrape off all the old paint; this may be done with an old knife or file, but the most satisfactory method is to use a wire brush. Before a new coat of paint is applied to ironwork, a coat of anti-rust priming should be applied.

New woodwork, before being painted, should be smoothed with glasspaper and a coat of patent knotting applied over all knots This should be followed by a coat of priming rubbed well into the wood; it does not matter very much what kind of paint is used for the priming so long as it will not clash too much with the proper paint. The priming coat should be rubbed down when dry so that a good surface is left. Usually two coats of paint are applied after the priming, but for a lasting surface, especially on exterior work, a third coat is advisable.

As far as possible, in applying paint, the strokes of the brush should be in the same direction. In painting a panelled door, the panels should be done first, then the centre portions between the panels known as the muntin, all covered with vertical strokes. The cross rails are painted with horizontal strokes, and the stiles, which are on the outside and run from top to bottom, painted with vertical

strokes. It will be seen that the beginnings and endings of the brush strokes on the inner portions of the door are covered in turn and the result is an evenly distributed series of marks.

It is a mistake to have too much paint on the brush, keep the paint well stirred and make sure that there is no sediment at the bottom of the tin. After dipping the brush into the paint, stroke it on the side of the pot to remove the surplus; it is a good plan to stretch a length of wire across the top of the paint pot from side to side and use it to wipe the brush on. In this way waste can be prevented, as drops of paint are less liable to fall.

When the paint is on the surface, work it well by moving the brush from end to end, gradually decreasing the pressure until the last strokes are as light as possible. When working close to glass, wallpaper or any surface which is not to be painted, protect it with a sheet of zinc or piece of cardboard, the latter should be wiped from time to time to keep it quite clean.

When a job is finished, put the lid on the paint pot so that the contents are quite air-tight; if a film is allowed to form on the surface of the paint, it will cause trouble when next the paint is used. When paint has been allowed to stand for a long time without being used, special attention should be paid to the surface. If a film should have been formed, remove it carefully before stirring.

As a rule there is no need to dilute paint either by the addition of linseed oil or turpentine, but for a priming coat, a little more turpentine can be added, and to impart a glossier surface, a little extra linseed oil can be added.

HOW TO USE ENAMEL

In many ways the methods of painting and enamelling are similar, because they both produce a glossy surface, although enamels are obtainable which impart a matt or semi-glossy surface Enamel is a high-grade paint made for use on either wood or metal, and it can be obtained in many colours. In enamelling particularly, the preparation of the surface is of first importance, and unless a good body of undercoating of suitable paint is applied, the finish will not be entirely satisfactory.

To deal first with the enamelling of new wood surfaces, the wood must be finished quite smooth with glasspaper, and a coating of stopping or shellac applied in order to fill up the pores of the wood. This is rubbed down smooth and followed by a couple of coats of paint, each one being rubbed down before the next is applied. For this purpose, glasspaper can be used, but the finest surface is obtained by using pumice powder, the method being to dust the powder on to a small piece of thick felt made slightly damp. Rub the pad with a circular motion, renewing the powder from time to time, and when the surface feels quite smooth, wipe it with a clean cloth to remove all dust and then proceed with the next coat. Care must be taken to see that the paint is quite dry before it is rubbed down. There are many proprietary enamels on the market, and manufacturers usually supply a suitable paint for the undercoating; this should not be applied to new wood until at least one coat of ordinary paint has been applied and rubbed down smooth.

To enamel existing paint work, either in the form

of furniture or on walls, first wash it with strong soda water, rinse with clean water and then rub it down. All cracks and holes should be filled up, and for this purpose obtain some finely ground whiting or plaster of Paris, mix it with gum to a thick cream and press it into the cracks with a stiff knife. When the stopping has dried quite hard, smooth it off and proceed with the undercoating.

The best brush to use is a flat bristle, bought ready ground or worn in by previous use with ordinary paint. The enamel should be stirred up thoroughly, every bit of the sediment at the bottom of the tin being incorporated, and it should not be allowed to settle until the work is finished. As enamel sets very much quicker than paint, any work begun should be finished at the one time, and to obtain the best effect, the work should be done in a warm dry room, free from dust. When enamelling the walls of a room, the windows should be kept closed until the enamel has set, and on no account should work be done in a damp atmosphere or in a low temperature.

In applying enamel, the brush should be held as lightly as possible and used with a slight pressure only. As enamel naturally spreads in all directions and forms a smooth surface without marks, the use of a coarse or even a heavy pressure with a fine brush will render the flow less effective. The surface should be covered evenly with light straight strokes of the brush, and every effort should be made to avoid having unequal quantities of enamel on the brush.

The above directions apply to the application of enamel on metal, but for this purpose special

enamel is obtainable. It is equally important to prepare the surface and to give it a good undercoating well rubbed down. In enamelling a bath, special bath enamel and undercoating should be obtained, but it is most important that the previous enamel or paint should be cleaned off to remove all traces of grease. The directions supplied by the manufacturer should be followed carefully, and when the enamel is perfectly dry, the bath should be filled with cold water, the plug removed and hot water allowed to run in. In this way the cold water will give place very gradually to hot, and when filled entirely, the hot water should be allowed to stand until quite cold.

ELECTRIC BELL BATTERIES

Faults in an electric bell system may be traced to various causes, but usually the cause of a failure to ring the bell when the push is pressed can be traced to a defective battery. It is possible that connections in the wiring have become loose or have corroded, and this sometimes happens to bell pushes exposed to rain or damp, but the first thing to do is to look at the battery.

Dry cells are now being fitted extensively to all modern bell circuits; these, with the intermittent use that electric bells are normally subjected to, should last for a considerable period. In the event of a gradual weakness of the current, the addition of a new dry cell will generally effect an improvement.

Large numbers of the wet Leclanché cell are in common use, especially in old houses. These cells

consist of an open glass jar, containing liquid, a central porous pot and a zinc rod. The liquid is made by dissolving sal ammoniac in water in the proportion of 2 ozs. of sal ammoniac to 1 pint of water, and it should be level with the black band marked on the outer bottle or jar.

In the course of time the water evaporates, and thus prevents the chemical action taking place. Usually a fresh supply of water will bring the battery up to full strength, but it is not a troublesome matter to mix up some new solution and fill up the battery again. Sal ammoniac can be purchased quite cheaply at most ironmongers and usually at all chemists. In examining the battery, it may be found that the liquid has crept up the connections and corroded them sufficiently to prevent close contact; in this case the connections should be separated, scraped clean and fastened again.

In old batteries, the zinc rod may have been eaten away by the action of the chemical, but it is not a difficult matter to renew it. The porous pot is composed of a mixture of powdered carbon and oxide of manganese surrounding a central carbon rod; it is very unusual for this portion of the battery to get out of order.

To examine an electric bell, the cover should be removed and tested with an ordinary pocket lamp battery or any dry cell, if the terminals on the cell are attached to the terminals on the bell, the hammer should vibrate and ring the bell. If this does not happen, the contact between the screw on the pillar and the springs of the armature which touches the ends of the coils may be faulty, the

point of the screw should be cleaned with a piece of fine emery cloth and readjusted.

There are other contact points connecting the wiring to the bell which should be examined, and if necessary, tightened up, and if the spring armature with its hammer extension works properly, the cell should be disconnected and the push tried again. If the bell does not work, it is possible that there may be a fault in the winding of the coils or their connections. The wire from the first cell terminal should pass through one coil to the next and on to the bracket supporting the spring armature. The wire from the other terminal should go direct to the pillar which carries the contact screw. The accuracy of all these contacts and circuits can be tested with a small pea bulb and a small cell.

Having tested the push, battery and bell, and still the battery does not fulfil its purpose, the fault must lie in the wiring. If the wiring is taken in sections and each section tested with a small lamp and a cell, it will be possible to isolate the faulty section and deal with it. The method of testing is quite simple and consists in securing a lamp to one of the terminals of a small dry cell with a short length of insulated wire with bared ends. The other terminal of the cell has a similar length of wire attached. The two free ends of the wire should be attached to the wires which are normally attached to the battery or the bell whichever is nearer the push end of the circuit. The push should be pressed, and if that length of wiring is correct, the lamp will light. Take other sections in the same way and continue until the faulty section is discovered.

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